DOCUMENT RESUME

ED 112 820 95 IR 002 182

TITLE Study of Education Satellite Communication Demonstration. Third Quarterly Progress Report. Report of Activities and Accomplishments January 11, 1975 to April 10, 1975.

INSTITUTION Syracuse Univ. Research Corp., N.Y. Educational Policy Research Center.

SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.

REPORT NO SURC-TR-75-542

PUB DATE 10 Apr 75

CONTRACT NIE-C-74-0046

NOTE 117p.

EDRS PRICE MF-$0.76 HC-$5.70 Plus Postage

DESCRIPTORS *Communication Satellites; Community Development; Cost Effectiveness; *Demonstration Projects; Educational Development; Educational Planning; Educational Radio; *Educational Research; Educational Technology; *Educational Television; Evaluation; Experimental Programs; Extension Education; Reports; Rural Education; Technological Advancement; *Telecommunication

IDENTIFIERS *Educational Policy Research Center; Educational Satellite Communication Demonstration

ABSTRACT

A report on the Education Satellite Communication Demonstration (ESCD) describes activities of the evaluators during the first quarter of 1975, including staff trips and site visits and activities of various staff members. A calendar of future events in satellites, telecommunications, and education is included, with revision on dates and new items. Working papers on satellites in education, ESCD costs, calculating the ESCD total cost, and utilization of television instruction are appended, with the note that these papers are in draft form and are being circulated for review and comments. (SK)

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Quarterly Report on the Educational Policy Research Center's Analysis and Assessment of the Educational Satellite Communications Demonstration

SURC TR 75-542

January 11, 1975 to April 10, 1975

IR 002 182

SURC

SYRACUSE UNIVERSITY RESEARCH CORPORATION

SURC TR75-542

THIRD QUARTERLY PROGRESS REPORT

Contract No. NIE C-74-0046

REPORT OF ACTIVITIES AND ACCOMPLISHMENTS

January 11, 1975 to April 10, 1975

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STUDY OF EDUCATION SATELLITE COMMUNICATION DEMONSTRATION

Prepared for:

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April 10, 1975

PREFACE

This is the third quarterly report of the Education Satellite Analysis and Assessment Project. A brief word may be in order on what the reader can expect to find within its approximately 120 pages. Except for notes on our own staff activities, which are self-explanatory, this report consists largely of a set of working papers. No attempt has been made to integrate them into a comprehensive report.

The reader will note, however, that a number of them are issue-oriented and that they offer some judgments, still tentative, on what is "knowable" about the potential of satellites for education. With the encouragement of our project officer at the National Institute of Education, we expect to circulate these papers among persons and groups interested in the potential of satellites for education. We are confident that our thinking will be greatly enriched by this process, and readers are reminded that we regard the issues raised by these papers as very much open.

In circulating these working papers, singly or in combination, we have set in motion a process which will culminate in our first annual report, due October, 1975. That report may well prove to be somewhat unusual for a contracted study. It will be the product of an extensive and iterative process of give-and-take with various reviewers, and dissents from our conclusions will be bound in the report (with reviewers' permission, of course).

As our earliest proposals to NIE made clear, we have never expected that there would be consensus on issues as complex as those with which our

study deals. All researchers recognize this, of course, and deal with it in varying ways. Some studies confine themselves to "safe" areas while others attempt to present all possible viewpoints, leaving the reader to wonder whether the analysts have any opinions of their own after studying the data.

We prefer a different approach, one in which the process wherein the annual report is developed is almost as important as the final product. As with the present group of working papers, we shall circulate drafts of our annual report, or chapters if appropriate, to a wide range of reviewers. These will include participants in the present demonstrations as well as many other interested groups--state officials, private organizations engaged in some aspects of telecommunications work, and other researchers. The first round of review will probably be somewhat informal in that participants should understand that we will expect to rewrite our drafts to incorporate new data and viewpoints. Reviewers of near-final drafts, however, will be afforded a formal opportunity to write up their comments exactly as they would wish them to appear in print, subject only to reasonable restrictions on length. Comments will be encouraged whether they involve strong dissents or simply alternative perspectives.

This kind of process is obviously more time-consuming than simply writing one's own report and letting differing viewpoints appear later in other places. We think, however, that the process outlined above will produce a more useful document, one whose data and logic has been subjected to critical scrutiny from a variety of viewpoints and which contains a number of those viewpoints as expressed by their holders.

It should also be noted that this Third Quarterly Report does not

contain a section dealing explicitly with the Appalachian Educational Satellite Project. Shortly before our (delayed) due date, new information came to light which tended to conflict with several of our conclusions. Since there was not enough time to review the new material, EPRC, with the agreement of the NIE Project Officer, has decided to publish the study of the Appalachian Educational Satellite Project in EPRC's Fourth Quarterly Report.

Returning to the present report, a concluding comment may be in order regarding the degree to which it deals with the on-going demonstrations. Although our work does to some degree involve an evaluation of the current projects, we have always emphasized, in our submissions to NIE and in contact with demonstration participants, that "project evaluation" is secondary to analysis of the issues. This conceptual position on our part has coincided exactly with the operating position of NIE which is that comments on the success or failure of the ESCD projects as demonstrations be kept to a minimum during the operational phase of the projects. That period has drawn to a close (the ATS-6 is being moved to a new position for broadcasts to India.)

One learns from the past only if one consciously attempts to apply its lessons to current and future issues. The projects themselves are in the process of providing a very full documentation of their activities and accomplishments and we do not propose to duplicate that activity. We do expect to apply that data to current issues and hope that the process we propose to use will insure that both the selection of issues and options available for resolving them will receive the attention and discussion that their importance warrants.

Table of Contents

Section	Title	Page
	PREFACE	i
I	SPECIAL ACTIVITIES AND SIGNIFICANT EVENTS	I- 1
	ESCD Project Examination Activities	I- 1
	Other Activities	I- 3
II	SATELLITES, TELECOMMUNICATIONS AND EDUCATION A CALENDAR OF FUTURE EVENTS	II- 1
	1.0 Satellite Launches, Uses or Movements	II- 1
	1.1 ATS-6	II- 1
	1.2 Communications Technology Satellite	II- 1
	1.3 Alaska	II- 1
	1.4 Commercial Broadcast and CATV Uses	II- 2
	1.5 United Nations Development Program	II- 2
	1.6 India	II- 2
	2.0 Legislation	II- 3
	2.1 The Public Broadcasting Financing Act of 1975	II- 3
	2.2 The Telecommunications Facilities and Demonstration Act of 1975	II- 3
	2.3 Copyright Revision Bill of 1975	II- 3
	2.4 All-Channel Radio Legislation	II- 3
	3.0 Regulatory Action	II- 4
	3.1 Federal Communication Commission	II- 4
	3.1.1 F.C.C. Cable Bureau	II- 4
	3.1.2 F.C.C. Common Carrier Bureau	II- 4
	3.1.3 ITU-WARC Conference 1979	II- 4
	4.0 National Activities	II- 5
	4.1 Corporation for Public Broadcasting	II- 5
	4.2 Public Service Satellite Consotrium (PSSC)	II- 5
	5.0 Conferences	II- 6
	5.1 International Communication Association	II- 6
	5.2 Conference on Instruction	II- 6
	5.3 Publi-Cable Conference	II- 6
	5.4 International Broadcast Institute	II- 6
	5.5 The Institute on the Public Interest in Telecommunications	II- 7
	5.6 University Applications of Satellite/Cable Technology Conference	II- 7
	5.7 International Telecommunication Union	II- 7
	5.8 Second National Conference on Open Learning and Non-Traditional Studies	II-7
	5.9 Conference on Communication Satellites for Health/Education Applications	II- 8
	5.10 United Nations/UNESCO Regional Seminar	II- 8
	5.11 United Nations/UNESCO Seminar-1976	II- 8
	5.12 US-India Communication Conference	II- 8

Section	Title	Page

APPENDECIES-WORKING PAPERS

INTRODUCTION. . . . . A- A

A WORKING PAPER ON SATELLITES IN EDUCATION. . . . . A- 1

Attachment I--Profile of the STD A-19
Attachment II--STD Goals and Objectives. A-22

B WORKING PAPER ON ESCD COSTS . . . . . B- 1

Introduction and Summary . . . . . B- 1
The FRMS/STD Data. . . . . B- 8
Organization of the FRMS/STD Data. B-10
Analysis of the FRMS/STD Cost Data B-19
Extending the Analysis B-22

C WORKING PAPER ON CALCULATING THE ESCD'S TOTAL COST. . . . . C- 1

Introduction . . . . . C- 1
Calculation Details. . . . . C- 8

D WORKING PAPER ON UTILIZATION OF TELEVISED INSTRUCTION . . . D- 1

SECTION I

SPECIAL ACTIVITIES AND SIGNIFICANT EVENTS

During the past quarter, the Educational Policy Research Center (EPRC) staff conducted visits to sites and project operations centers in the Rocky Mountain area, Appalachia, and Washington. Some of the reflections about, and interpretations of, what was learned on these visits can be found in the "Working Papers" Section of this Report.* The present Section is essentially descriptive. It begins with discussions of the EPRC staff activities in the ESCD projects, and is followed by similar discussions of EPRC project activities which did not directly relate to the ESCD.

I. ESCD Project Examination Activities

A. Rocky Mountain States

On March 11-12, Dr. Baldwin visited Satellite Technology Demonstration (STD) offices in Denver to review STD progress and discuss issues pertaining to the working paper contained in this report. He spent March 13 in Salt Lake City and Heber City, Utah, in the company of the Utah STD State Coordinator, Dr. Arthur Bishop, Utah State Board of Education. In addition to visiting the interactive site at Heber City, he met with Bryon J. Openshaw, director of public television station KUED, Salt Lake City.

On March 14, Dr. Baldwin visited the interactive site at Hayden, Arizona, in the company of Arizona STD State Coordinator, Dr. Buel N. Bowlan, Arizona Department of Education. At both sites, he pretested a draft questionnaire to be used to solicit the views of the Local Advisory Panel being established at this writing.

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* Additionally, new activities have been conducted in regard to the Local Advisory Panel.

On March 24, Dr. Baldwin joined Dr. DeWitt, EPRC Satellite Project Director, on a review of EPRC work with NIE project officer Richard Holt. The format of the first annual report was the principal agenda item.

From Washington, Dr. Baldwin went on March 25 to the Resource Coordinating Center at the University of Kentucky, Lexington, to discuss demonstration issues and review evaluation plans in the Appalachian region. He met with Dr. David Larimore, RCC director, and a number of the RCC staff members.

Although Dr. Root is the primary liaison with Appalachia projects, he and Dr. Baldwin are coordinating attempts to familiarize themselves with both the Rocky Mountain and Appalachian regions. In early May, Dr. Root is scheduled to visit Colorado sites, and Dr. Baldwin and other staff members will visit sites in Appalachia.

At various times during the quarter Dr. Baldwin has talked by phone to all but one of the eight STD State Coordinators in the Rocky Mountain demonstration area.

During April, Dr. Baldwin contacted Dr. Douglas Sjogren, Professor of Education, Colorado State University. Dr. Sjogren agreed to serve as a consultant to EPRC. He will review the research plans of the Statellite Technology Demonstration to facilitate EPRC's subsequent analysis of that effort.

B. Appalachia

During the past quarter, Dr. Gus Root has visited the following:

January 9-10:	ARC in Washington to peruse ARC files in the company of ARC representative, Robert Schuman.
January 21:	The Clinch-Powell RESA located at Harrogate, Tennessee.
March 24:	Visit to ARC in Washington in the company of EPRC's Dr. Baldwin and Dr. DeWitt. Dr. Root continued discussions concerning procedures for maximizing EPRC access to ARC and RCC files for research documents.

March 25: Dr. Root visited the DILENOWISCO RESA located at Norton, Virginia.

April 14-15: Dr. Root visited the TARCOG RESA at Huntsville, Alabama.

In all of these contacts, attention has focused on the following factors: an analysis of the Appalachian ESCD history; the decisions that individuals and agencies have made to become involved in the project; the functions performed by the media used in the project; and the outcomes of the project in terms of changes in persons and institutions. During this period, frequent discussions with other EPRC observer-evaluators has helped to clarify and sharpen perceptions of the critical factors to observe and analyze.

C. Alaska

Dr. DeWitt, Dr. Baldwin and Steve Porter visited Practical Concepts, Inc. in Washington on January 23 to discuss negotiations of coordination with PCI and CNER's activities in Alaska. The results of this meeting have been summarily discussed in PCI's 3rd Bi-monthly Report, Section VI, pages 6-10.

In addition, EPRC has arranged with Lou-Ann Packard at Alaska Office of Telecommunications to obtain Alaska ESCD cost and accounting data which will be relevant to EPRC's cost study of the ESCD.

In addition, Steve Porter engaged in a preliminary perusal of documents in NIE files relevant to the EPRC history of the ESCD during March 13-14, and March 19-21. NIE's cooperation with these efforts has been greatly appreciated.

II. Other Activities

A. Peter White

1. Attended the organizational meeting of the Public Service Satellite Consortium (PSSC) in San Diego, California, February 18, 19, 20 and

2. Attended the American Educational Research Association in Washington, D.C., March 30-April 3. At that meeting he

a) M[illegible] and participated on a panel with the members of the Educational Testing Service evaluation staff for the PLATO and TICCIT computer education projects.

b) Attended the AERA sessions on the Evaluation of the HET demonstrations and experiments.

B. John Hudder

Mr. Hudder visited FRMS offices in Denver to become familiarized with some aspects of the demonstration. This occurred in December, 1974.

Phone calls were made to Richard Campbell and Austin Connolly at FRMS during the past four months for requests of data and for consultation over interpretation and assignment of cost data among operating functions. Similar calls were made to Dennis Goldstein of ARC in February, March, and April and, more recently, to Dee Maynard at the University of Kentucky, Lexington.

Finally, EPRC consultant Marshall Jamison was contacted in February to confer over the use and interpretation of cost data and to obtain information with respect to optimal satellite communication systems.

C. Naomi White (Local Advisory Panel)

The formation and inclusion of the Local Advisory Panel in the EPRC study has progressed well. Activities related to the Panel are listed below and the progress of each is briefly described.

1. Construction of the Questionnaire:

First draft questionnaires have been successively pretested in the Rocky Mountain and Appalachian regions. Work on the final form of the questionnaire is near completion and it is anticipated that the questionnaires will be mailed out in the first week of May.

2. Selection of the sites and recipients of the letters of invitation:

A random selection was made of sites to be included in the drawing of the Panel. For the Appalachian region, this effort included controlling for the type of course offered (Reading or Career Education) and the semester in which it was offered.

3. Letters of invitation to participate in the Panel have been sent to teachers, administrators, school board members, and other personnel related to the satellite demonstration.

Responses are still being received--the breakdown of responses to the invitations thus far received is as follows:

Total number of invitation letters sent out--Appalachian Region, 214; Rocky Mountain Region, 226 for total of 440.

Number agreeing to participate in the Panel--Appalachian Region, 64; Rocky Mountain Region, 80 for total of 144.

Another fifty invitations will be sent out to potential participants in the Appalachian region at the same time as the questionnaire. Those receiving the latter will be invited to participate in the Panel only if they so desire.

Alaska

At the suggestion of Mr. R. Holt, and in collaboration with Practical Concepts, Inc., in Washington, its subcontractor, CNER in Fairbanks, Alaska, and EPRC Syracuse, a decision was made to extend the Local Advisory Panel to include teachers and relevant administrators and community personnel involved in the Alaska ESCD.

CNER has undertaken to select the Alaskan sites, to determine the persons to whom the invitation letter shall be sent, to be responsible for the invitations

and to devise any additional questions which are particularly relevant to the Alaskan ESCD, and which CNER feels should be included in the questionnaire.

Because of the short time available, the initial letter to Alaskans will simply alert them to expect a questionnaire and explain the arrangements for participation. All individuals sent the initial letter will also receive a questionnaire and they can then decide whether or not they wish to respond.

SECTION II

SATELLITES, TELECOMMUNICATIONS AND EDUCATION
A CALENDAR OF FUTURE EVENTS

1.0 SATELLITE LAUNCHES, USES OR MOVEMENTS (Partial Listing)

1.1 ATS-6 (UPDATE)

At the time of writing ATS-6 is scheduled to move from its present location on either May 16 or May 20 and, as a consequence will not be available for current ESCD experimenters. The ATS-6 is expected to reach its new position by July 1, 1975 so that it can be used in the Apollo-Soyuz mission on July 15, 1975 and then be used in the Indian SITE experiment. Official plans call for the return of ATS-6 to the U.S. at the completion of its Indian activities. The return date is expected to be about September 15, 1976--and this coincides with the beginning of the school year.

1.2 Communications Technology Satellite (CTS) (UPDATE)

The Communications Technology Satellite is a cooperative effort between the U.S. and Canada. Launch is scheduled for December 1975, with experiments scheduled to commence in April 1976. Experiments have been scheduled for one year but the space-craft has a design-life of two years.

At the present time three CTS user experiments have obtained funds for their operation. They are a) Digital Video College Curriculum Sharing Experiment to be conducted by NASA-Ames Research Center, Carelton University, Ottawa, Canada and Stanford University, Stanford, California. b) Communications Link Characterization Experiment to be conducted by the NASA-Goddard Space Flight Center. c) Transportable Emergency Earth Terminal to be conducted by COMSAT.

At least nine other experiments are in the planning stage.

1.3 ALASKA (CORRECTION)

In the last edition of the Calendar it was incorrectly stated that the Public Utilities Commission was reviewing the RCA/ALASCOM Plan for Alaska. In fact it was the Governor's Office of Telecommunications which was reviewing the RCA proposal and representing the State of Alaska before the Federal Communications Commission. The Public Utilities Commission can only deal with regulatory matters while the Governor's Office of Telecommunications Policy determines state policy.

Small Earth Terminal Procurement (NEW ITEM)

The State of Alaska has issued requests for proposals for the procurement of from 100-150 small earth terminals. These terminals will utilize existing or planned domestic satellites employing standard C band transponders.

The earth terminals, when coupled with existing communications facilities, will provide the basic system of communication for all rural Alaskan communities with a population of 25 or more. The communities will then have access to basic emergency medical communications and basic telephone services. The provision of these services will meet the objectives of Phase I of the Alaskan plan for telecommunications.

In Phase II, the Governor's Office of Telecommunications and the interim telecommunications committee of the State Legislature will undertake a six to nine-month study. They will consider the options available for a state-wide television distribution system and other communication services which are beyond the capability of the Phase I system.

1.4 COMMERCIAL BROADCAST AND CATV USES (NEW ITEM)

--Western Union Co. and the Midwestern Relay Co. have announced an agreement to connect Western Union's Satellites with Midwestern's Microwave Network linking 52 television stations. Terrestrial links will be from ground stations in New York, Los Angeles, Dallas, Atlanta, and Chicago.

--TV News will also use Western Union Satellites to distribute television material to 75 stations.

--Talks are also underway between Home Box Office--the pay-cable subsidiary of Time, Inc. and Target Network Television a cable company serving cable systems in seven mid-west states. Because of their service requirements, they are considering sharing a single satellite television channel.

1.5 UNITED NATION DEVELOPMENT PROGRAM (NEW ITEM)

The feasibility of educational satellite systems is being considered in three studies being conducted under the auspices of UNDP. The studies are for Indonesia, and Iran.

1.6 INDIA (UPDATE)

India's INSAT I program (its first domestic communications satellite) has been indefinitely postponed. There will therefore now be no follow-on to SITE which utilizes the ATS-6 Satellite and a variety of ground reception and redistribution systems. This could mean an end to India's educational satellite programs.

2.0 LEGISLATION

2.1 THE PUBLIC BROADCASTING FINANCING ACT OF 1975 (UPDATE)

The Public Broadcasting Financing Act (H.R. 4563) was introduced into the House on March 10. It is identical to the Senate version (S. 893) of the bill which was introduced in that chamber on February 29. It would authorize and appropriate federal funds for CPB for a five-year period, fiscal years 1976 through 1980. The federal allocation for each fiscal year would be based upon the total nonfederal funds raised by public broadcasting for the second preceding fiscal year. The bill sets ceilings, however, of $70 million for 1976, rising to $100 million for 1980. This bill has been approved by the Senate Commerce Committee and, at the time of writing, hearings are being held by the House Communications Subcommittee.

This bill has a provision of relevance to future satellite activities. It expands the scope of the Public Broadcasting Act of 1967 and allows for the development and use of nonbroadcast communication technologies for the distribution of radio and television material.

2.2 THE TELECOMMUNICATIONS FACILITIES AND DEMONSTRATION ACT OF 1975 (UPDATE)

The Telecommunications Facilities and Demonstration Act (H.R. 4564), introduced into the House on March 10, would authorize appropriations totaling $35 million for fiscal years 1976 through 1980. An extension of the educational broadcasting facilities program, it would continue direct support for over-the-air educational radio and television broadcasting facilities and also provide authority for a non-broadcast telecommunications program designed to demonstrate ways of meeting the common needs of the health, education, and social-service communities. The bill does not specify how the funds would be allocated between broadcast and non-broadcast projects. The Hearing dates for this bill will be known some time after April 10, 1975.

2.3 COPYRIGHT REVISION BILL OF 1975 (UPDATE)

Comprehensive copyright revision bills (S. 22 and H.R. 2223) have been reintroduced in both houses of Congress, and action is expected soon.

Both bills are the same as the bill passed last session by the Senate. No Hearing dates have been set but they are expected to be held in the late Spring. The 1974 bill removed Public Broadcasting's exception from payment of fees to copyright holders. This would have a significant impact on public broadcaster's use of copyrighted material such as music, books, and photographs.

2.4 ALL-CHANNEL RADIO LEGISLATION (NEW ITEM)

A bill requiring that all radios retailing over $15 be equipped to receive both AM and FM signals was passed by the Senate during the 93D Congress. It is expected that another form of the bill will be introduced during the current session. Passage of this bill would eventually have an impact on the potential audience for public radio stations which are predominantly located in the FM Band. It should be noted that similar legislation mandating that all television sets be equipped to receive both VHF and UHF signals led to the development of an enlarged audience for UHF - and hence public television stations.

3.0 REGULATORY ACTION

3.1 FEDERAL COMMUNICATION COMMISSION

3.1.1 F.C.C. Cable Bureau (NEW ITEM)

The F.C.C. Cable Bureau plans to coordinate a study of current educational uses of CATV. The research will investigate the current utilization of educational access channels as a prelude to the formulation of future FCC policy on the provision of educational access channels. At the present time, the National Science Foundation, Office of Telecommunications Policy and the National Institute of Education are involved in the efforts.

Although this research effort is not directly related to satellite distribution systems it is safe to say that satellite distribution of educational materials would involve the use of terrestrial redistribution systems.

3.1.2 F.C.C. Common Carrier Bureau (NEW ITEM)

The Federal Communications Commission's Common Carrier Bureau had planned a meeting between Corporation for Public Broadcasting and companies authorized to provide domestic satellite service.

The meeting, tentatively scheduled for mid-April was being organized at the request of Henry Loomis, President of C.P.B. He wanted to discuss the terms of access for public broadcasters to authorized domestic satellite systems.

Mr. Loomis had asked the FCC to "(a) require domestic satellite system operators to compile and make available cost data necessary for proper consideration of free or reduced rates; and (b) bring representatives of public broadcasting and authorized domestic satellite systems together in an informal meeting held under the auspices of the Commission or its staff so that methods of ascertaining the terms of public broadcasting access can be discussed."

The request for a meeting came at a time when CPB expected a substantial increase in terrestrial interconnection service costs when their current contract expires later this year.

The meeting was subsequently postponed at the request of CPB because it was concurrently discussing this issue and related matters with the common carriers. (See Item 4.1.)

3.1.3 ITU-WARC Conference 1979 (NEW ITEM)

Planning is underway for the 1979 International Telecommunication Union Conference. The FCC has requested statements from interested parties according to FCC Docket 20271. The FCC has until mid-1977 to study a variety of frequency allocation issues. The final United States position will result from the deliberations of the FCC and IRAC. The official U.S. representative to the ITU is the Department of State. Topics to be discussed include, communication satellite frequencies, radio relays, land mobile service and high frequency fixed services.

4.0 NATIONAL ACTIVITIES

4.1 CORPORATION FOR PUBLIC BROADCASTING (NEW ITEM)

The Ford Foundation has sponsored a study for CPB and PBS. It was designed to consider the future interconnection options for public broadcasting. The study was completed and CPB/PBS are now involved in discussion with common carriers including those authorized to provide domestic satellite services.

We conjecture that CPB/PBS have at least three distinct options available and that each option would have a significant impact on the development of public telecommunications services. The options are as follows:

a) CPB/PBS could continue their operations very much as they are now -using a variety of terrestrial interconnection services. On the basis of their other options they might be able to bargain with their current suppliers and avoid the proposed 30-40% rate increase. This option might make it expensive to expand their service to parts of the country not yet served by public broadcasting.

b) Negotiate a favorable rate with authorized domestic satellite carriers. This would involve leasing a transponder--probably in the 4-6 GHz range.

c) Arrange for service in conjunction with the Public Service Satellite Consortium. Since the inception of the PSSC, CPB/PBS have played an active and supportive role. It would probably be most advantageous for the PSSC if CPB/PBS were to buy its interconnection services through the PSSC. The likelihood of this occurring is difficult to judge because there appears to be a significant difference between the felt need of other PPSC members and CPB/PBS. This hinges on the fact that most PSSC members need a service designed for a large number of relatively low-cost ground stations. Because CPB/PBS need to interconnect a relatively small number of ground stations they are less interested in low cost ground stations, and as a consequence, are interested in a system with quite different technical characteristics. (See Items 1.4, 3.1.2.)

4.2 PUBLIC SERVICE SATELLITE CONSORTIUM (PSSC) (UPDATE)

The Public Service Satellite Consortium (PSSC) is in the process of incorporationg the State of Delaware. The PSSC is seeking federal funds which would enable it to hire a small staff and undertake market research and development over the next two years.

5.0 CONFERENCES

5.1 INTERNATIONAL COMMUNICATION ASSOCIATION
Annual Meeting

April 23-26, 1975. Chicago
Conference theme: Communication and the Urban Environment

5.2 CONFERENCE ON INSTRUCTION (NEW ITEM)

May 11-14, 1975. Philadelphia
May 18-21, 1975. Los Angeles

Sponsored by Corporation for Public Broadcasting and the National Association of Educational Broadcasters.

The general theme will be the direction of instructional telecommunications in the next five years with a major activity being a discussion of the CPB Advisory Council of National Organization's Education Study. Other areas will include, programming, new technology, system development, legal decisions and Federal legislation.

5.3 PUBLI-CABLE CONFERENCE (NEW ITEM)

May 22-24, 1975.

Its Fourth Annual Conference will be held at the University of Louisville, Kentucky and will include sessions on the relationship of public and educational broadcasting to cable, cable television in Canada, and cable-satellite programs in Appalachia. For information, contact: B.J. Patterson, (202) 833-4108, or write to the Publi-Cable office, 1201 16th Street, N.W., Washington, D.C. 20036

5.4 INTERNATIONAL BROADCAST INSTITUTE (NEW ITEM)

May 25-29, 1975. Ottawa (By Invitation Only.)

The Future Role of New Communications Systems organized by the International Broadcast Institute in cooperation with the Canadian Broadcasting Corporation and the Department of Communications.

5.5 THE INSTITUTE ON THE PUBLIC INTEREST IN TELECOMMUNICATIONS (NEW ITEM)

June 2-27, 1975. New York City

The Institute will cover four areas:

a) Television: A Psychopedagogic Tool
b) Business of Broadcasting - Commerce or Communications
c) Control of Communications Policy
d) Case Studies in Research and Action -
   Cable TV
   Satellites
   Public Television

Contact: The Network Project
101 Earl Hall
Columbia University
New York, New York 10027

5.6 UNIVERSITY APPLICATIONS OF SATELLITE/CABLE TECHNOLOGY CONFERENCE

June 3-5, 1975. Madison, Wisconsin

The broad aim of the conference is to stimulate discussion among universities, industry and government on the national and international possibilities of satellite and cable development in the next decade. The conference is sponsored by the University of Wisconsin-Extension Department of Communication, Center for Health Sciences, Department of Engineering, University of Minnesota and the Midwest Universities Consortium for International Activities. For details, contact: Dr. Lorne A. Parker, (608) 262-4342.

5.7 INTERNATIONAL TELECOMMUNICATION UNION

June 6, 1975. Geneva, Switzerland

Biannual Symposium on Space and Radiocommunications.
Theme: "Satellites in Aeronautics."

5.8 SECOND NATIONAL CONFERENCE ON OPEN LEARNING AND NON-TRADITIONAL STUDIES (NEW ITEM)

June 17-19, 1975. Washington, D.C.

This conference will include extensive discussion of technology-based open learning systems. It is jointly sponsored by the University of Mid-America, the Joint Council on Educational Telecommunications, and the Council for the Program on Non-Traditional Study. For further details, write:

University of Mid-America
Designing Diversity 75
P.O. Box 82006
Lincoln, Nebraska 68501

5.9 CONFERENCE ON COMMUNICATION SATELLITES FOR HEALTH/EDUCATION APPLICATIONS (NEW ITEM)

July 21-23, 1975. Denver, Colorado

This is an international conference jointly sponsored by the American Institute of Aeronautics and Astronautics, the Joint Council on Educational Telecommunications and the Veterans Administration Department, Department of Medicine and Surgery.

The conference is designed to allow for interaction between the designers and users of communication satellites.

General Chairman - Mr. Henry Dornbrand: Fairchild (301) 428-6000
Chairman for Technical Program - Dr. Richard Marsten: NASA (202) 755-8582
Chairman for Health/Education Experiments Programs -
Mr. Frank Norwood: JCET (202) 659-9740

5.10 UNITED NATIONS/UNESCO REGIONAL SEMINAR (NEW ITEM)

August 27-September 4, 1975. Mexico

The topic will be satellite broadcasting systems for education for the benefit of Latin and Central American and Caribbean Countries.

5.11 UNITED NATIONS/UNESCO SEMINAR - 1976 (NEW ITEM)

The UN Secretariat is considering the possibility of holding a seminar of satellite broadcasting systems for education and development. This would be an interregional seminar for the benefit of States in the ESCAP and ECWA regions which are specifically interested in using satellite instructional television systems for education and development.

5.12 US-INDIA Communication Conference (LATE ADDITION)

August 18-22, 1975. New Delhi

Sponsored by the Speech Communication Association's Commission for International and Intercultural Communication.

The Conference themes include, among others, American and Indian perspectives of intercultural communication in pluralistic societies, communication and the Indo-American relations, and communication and national development.

Conference Chairman: Dr. Nemi C. Jain, Department of Communication, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin, 53201.

APPENDIX--WORKING PAPERS

Introduction

The working drafts included in this appendix section exemplify some of the preliminary analysis tasks we are currently engaged in. Other tasks are in earlier phases of their development and will be reported on later.

We assume that readers appreciate the generally tentative character of these papers. We are well aware that some of the interpretations they suggest may be based on as yet inconclusive evidence. In some cases, the evidence awaits taking a form that permits public documentation. For this and other reasons, the documentation of materials has been generally kept at a minimum though this will naturally change as the analyses mature. Working papers do not necessarily express the views of the EPRC.

These papers have been circulated to the Appalachian Regional Commission, the Federation of Rocky Mountain States, the Alaska Governor's Office of Telecommunications and the National Institute of Education prior to their publication in this document. Wherever the papers contain errors of fact or interpretations with which those organizations disagree, EPRC takes full responsibility.

It is EPRC policy that public discussion of the issues we want to address be initiated while work is still going forward. The working drafts in this section are intended to stimulate general interest in our concerns and to promote a dialogue among all interested parties. We will appreciate critical commentary from readers no less than new or relevant information.

APPENDIX A

WORKING PAPER ON SATELLITES IN EDUCATION

This is the second working paper on communication satellies in education based largely on observations of the Satellite Technology Demonstration (STD), which is being conducted by the Federation of Rocky Mountain States. The first paper, which appeared in the second EPRC quarterly report to the National Institute of Education, contained a brief history of the STD, a description of its operations, and a few comments on issues which seemed worth further exploration.[1]

The present paper offers some tentative conclusions on several issues relating to the future uses of satellites in education. These tentative conclusions are as follows:

1) Two-way voice communication, or "live interaction via satellite," is not compatible with economical use of satellites in elementary and secondary schools because the large audiences required for economy preclude more than symbolic participation. Moreover, the entire rationale of this kind of programming in public education is extremely weak.

2) Because of the scheduling and other disadvantages of having to view programs at the time they are broadcast, it seems likely that school participation in future projects will wish to videotape almost all tape and film materials for replaying at their convenience. Therefore, the most promising mode of satellite usage in American education appears to be some kind of "materials distribution service," but it remains to be seen whether this will be cheaper or more reliable than mailing out videotapes in the first place.

The purpose of this paper is to join debate on the issues raised by these

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[1] A short profile of the STD abstracted from the first paper is attached. Readers not familiar with the project may wish to read that profile before proceeding further. (Attachment I.) Although most of the data contained in this paper comes from the STD experience, some material from the Appalachian demonstration is included. The absence of Alaskan data is an obvious omission Subsequent treatment of these issues will require integration of the experience of all three ESCD projects, as well as data from other sources.

preliminary judgments. Conclusions with which a reader agrees are usually tardy, and those with which he disagrees are always premature. Unfortunately, the most effective way to get criticisms of one's data and conclusions is to publish them prematurely. This and other working papers will be given wide circulation, and their conclusions may be modified in response to comments and new data. Comments will be incorporated into our first year-end report with permission of their authors.

To avoid tedious repetition of caveats throughout the paper, it may be well to remark at the outset on the firmness, or lack thereof, of these conclusions. It should be obvious that judgments of the kinds offered here cannot be taken as established facts, and they are all to some degree contested by other anlysts of satellite-based systems. They are not in any final sense provable. The first judgment might, in some circumstances, be disprovable, but the information to be gained from the Educational Satellite Communications Demonstration, which includes the STD, will suffice neither to prove nor disprove it.

An earlier draft of this paper was provided STD management for comment. They are not responsible for any errors of fact it may contain, nor should they be assumed to agree with its conclusions.

Conclusion #1: Discussion

> Two-way voice communication, or "live interaction via satellite," is not compatible with economical use of satellites in elementary and secondary schools because the large audiences required for economy preclude more than symbolic participation. Moreover, the entire rationale for this kind of programming is extremely weak.

The first thing to be said is that two-way voice communication between

classrooms via satellite has not had a fair test in the Rocky Mountain region for reasons outside the STD's control. As noted in an earlier paper, the two-way voice communication is carried on a VHF frequency via ATS-3, satellite launched in 1967 which is less powerful than ATS-6. The STD management attempted to persuade the Federal funding agencies to put additional voice transmission equipment on the more powerful ATS-6 at the 2.5 GHz frequency of the video telecasts, but the proposal was turned down.

Voice communication from one of the 24 interactive sites to the studio, when broadcast live over the air, normally cannot be understood at other sites. It is apparent that studio technicians often have difficulty in separating the message from static and other noise. There have been occasional exceptions. This writer heard two live interactive sessions in classrooms during a recent visit to receiving sites and, during one of them, was for the first time able to understand most questions. The teacher said that it was one of the two or three clearest transmissions of the year.

Parenthetically, a report from the National Aeronautics and Space Agency (NASA) provides an example of the caution which must be exercised when interpreting official assessments of operating performance. The relevant passage, quoted in its entirety, reads as follows:

> Although this report is directed principally toward TV broadcast, the VHF interactive capability is briefly noted because it is a part of HET. Reliability performance of the HET VHF elements are totally consistent with prior experience, which is approximately 90%, cumulative for ATS-1 (launched 1966) and ATS-3 (launched 1967).[2]

This summary of a multi-year operating record in a sentence, and the absence

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[2]Communications Programs, Office of Applications, Technical Effectiveness of Satellite Television Broadcasting to Remote Areas (ATS-6). (NASA: Washington, D.C., March 31, 1975, p. 23.)

of any reference to sound quality, creates a misleading impression of overall performance.

The inability to hear what is being said naturally has prevented the two-way voice sessions from developing as planned. After experimenting unsuccessfully during the first semester with several formats to promote discussion, the STD continues to rely heavily upon the technique of repeating and answering over the air questions from sites. There is also a significant amount of live broadcast time devoted to studio commentary. A promising idea which is being tried out at this writing is to let participating sites develop their own programs for Fridays. These programs will consist of scripts, slides and films on job opportunities at the local site, prepared by students for broadcast from Denver. By mid-April, seventeen sites had indicated that they wanted to put on such programs. This format, called "Open Fridays," is a major step toward decentralizing STD programming, but it is also a step away from the spontaneous "interaction" originally hoped-for. Although there is to be a question-and-answer session at the end of each presentation, the basic idea of "Open Fridays" is not dependent on the existence of two-way voice capability. In fact, four of the seventeen participating schools are without two-way capability.*

In view of the technical difficulties, it may seem unwarranted to conclude that two-way voice communication, or "live interaction," is unpromising for elementary and secondary school educational purposes. The acceptance data collected by the STD Research Component indicates that the two-way capability is seen as desirable both by schools which have it and schools which do not.

The difficulty in generalizing from STD acceptance data is that extra

*The STD staff indicates, however, that these four classes are planning trips to nearby interaction sites on the Friday's when their material is telecast in order to be able to respond to questions and comments.

levels of services do not carry additional costs to the participating schools. When this assumption is changed, acceptance changes. In January, the STD sent a questionnaire to its 56 rural sites inquiring about interest in future participation in satellite-based telecommunications services. The STD received 75 responses from 42 sites (56 from school administrators, 17 from school board members, and two others). The acquisition cost for an interactive terminal at each school was assumed to be $11,000, compared to $6,500 for a receive-only terminal. According to a February 14 report issued by the Federation, about half of the 75 respondents would buy interactive services at the latter price, compared with about three-quarters accepting receive-only terminals.[3] The report commented that the past technical difficulties with two-way audio might have influenced those results.

Those suggested prices, however, are only a part of the total cost of live two-way programming. Although data on costs is still a subject of controversy, a few simple points can be made.

First, the addition of extra capacity of any kind adds something to the initial cost of the satellite system. If this proves to be only a few hundred thousand dollars, that is a few thousand dollars more for a hundred sites.

Second, live interaction requires people in the broadcast studio to interact with,[4] unless it is assumed that absolutely spontaneous discussions

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[3]The published data does not permit calculation of exact percentages since three combinations of interactive capacity, including digital equipment, were mentioned. A few respondents rejected voice-only interaction but chose a combined package.

[4]It also requires that a live audience be in place at a specified time, a matter to be discussed in a subsequent section of this paper.

will take place among participants across classroom sites. In an ordinary classroom, creating apparently spontaneous yet focused discussion is usually seen as more demanding than delivering a lecture. The STD experience shows that this difficulty is compounded when the "classroom" is a number of dispersed sites, even when the number is as low as twelve.[5] Although televised instruction is normally thought of as capital-intensive, a two-way communication system is relatively labor-intensive.

Third, a major argument for televised instruction is that, although total costs are high, the per-pupil costs are low because of a capacity to reach mass audiences simultaneously. This argument does not appear to hold for live two-way voice communication.

Fourth, to try to use the satellite-dependent portions of an educational communications system to stimulate live interaction among people is to rely on technology at the point where its competitive advantage over the humans within the system is weakest. In evaluating the advantages and disadvantages of equipping an educational satellite system with two-way voice equipment, it is important not to fall into the assumption that one is deciding the merits of "interaction" vs. "passivity" in the classroom, or any similar pair of words. What one is deciding is not whether interaction should take place, but whether it is important that some of it take place via satellite. In short, questions of feasibility aside, the rationale for two-way voice communication via satellite in public school education is not very compelling.

Before turning to the latter point, which is actually the most important

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[5]The reader should keep in mind that the STD broadcasts at two different times into two receiving areas or "footprints," so that only 12 sites at a time can participate in two-way voice communication.

one, it may be well to consider some of the operational matters. The evidence does not permit very firm judgment on what might be possible under improved technical conditions, but it is not encouraging.

A few numbers may help the reader fix in his mind the scope of the Rocky Mountain region demonstration. Except as a way of keeping the discussion within bounds, the calculations are not important. Two-way communication takes place across twelve sites at a time, with a first-semester average of 26 pupils per site, or somewhat over 300 pupils in all. More than one-third of the total broadcast time for the junior high school career education programs was "interactive."[6] Had the question-and-answer format been used exclusively during a semester (which it was not, since the STD experimented with several formats), each student might have asked a maximum of three questions per semester, or one every five or six weeks.[7] This is not to argue that a question-and-answer mode is the best use of the medium, nor to deny the benefits of hearing other students' questions asked and answered; it is simply a reminder that even with a much smaller audience than one would expect in operating programs reaching elementary and secondary schools, the quantity of direct individual interaction is not large.

A very fair objection might be made that this kind of arithmetic is not meaningful since it ignores the value of vicarious participation as an element in learning. This is quite true, but there must be a point of diminishing returns somewhere. Otherwise, it would be sufficient to tape a few classrooms

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[6] I.e., 6 minutes X 4 days (Monday-Thursday), plus 36 minutes on Friday, over 29 minutes X 4 days; or, 60/116 minutes.

[7] The STD staff reports that 992 questions were responded to during the first semester across the 24 interactive sites, or about 1.5 questions per student. They state that the number has "almost doubled" during the second semester. This number could be increased significantly by handling questions off the air, using one or more studio staff members to combine duplicative questions.

asking and answering questions to achieve the effect of live interaction. Where diminishing returns to education set in, of course, remains a matter of speculation.

For what it may be worth, the present writer raised this question with various members of the University of Kentucky staff, which developed and broadcasts programs in the Appalachian portion of the satellite demonstration. The Appalachian interactive sessions enjoy several advantages relative to those of the STD. The audience size is also about 300 (20 teachers at each of 15 sites). However, the audience is composed of teachers taking the course for graduate credit, who presumably share some common vocabulary and purpose. An early decision to handle incoming questions off-camera makes for a smoother process and bypasses the problems of poor sound quality over ATS-3. Nevertheless, the largest estimates from the University of Kentucky staff of the number of teachers who might profitably participate in discussions via satellite was "about twice" the present size, i.e., about 600. (More precisely, most people judged that the limiting factor would be the number of sites--i.e., a maximum near 30--with some room for variation in class size per site.)

A comparable judgment for the teacher-education programs ("Career and the Classroom") offered by the STD which have a combined enrollment of about 800 teachers in the two receiving areas, may be invalid because of the sound problems. On the entirely subjective level, this writer's observations of the "Time Out" series led to the conlcusion that the point of diminishing returns for interaction via satellite may have been approximated in the present demonstration. Direct observation, supplemented by comments from state and local personnel, indicates that students are indeed very interested when their own class is on the air, but markedly less interested when any other

class is. (Their reactions when they themselves are on the air appeared no different from those of students hearing each other's voices from a tape recorder in the room.) Questions about preferable formats and maximum audience size are very much open.

The STD has shown a strong interest in digital equipment, which moves the issues of "interaction" into the general domain of computer-assisted learning.[8] This is a larger area than the present paper can deal with. Three points will suffice here. Computer-assisted systems (a) partially solve the problem of audience size since the computer can field hundreds of questions for which it has been programmed in advance apparently instantaneously, (b) increase per-site capital costs,[9] and (c) compound, at least initially, all the really difficult problems of designing courseware and programming software.

The main danger of too much attention to questions of "How?" and "How Many?" is that they may distract attention from the question "Why?" A review of early Federation proposals relating to two-way audio (and digital) equipment fails to reveal any systematic effort to formulate educational goals for the interactive components, despite several strong expressions of enthusiasm for their educational potentials.

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[8] In commenting on an earlier draft of this paper, STD staff agreed with many of the comments on the limitations of voice-only interaction, but maintained that added digital capacity would have significantly enhanced the quality of the system. The contention deserves serious consideration, but is of course unknowable from existing data. As the discussion will show, the present writer's tentative conclusion is that the rationale for the system is not strong enough no support the assumption that more, or better, hardware would substantially improve its usefulness.

[9] The STD estimates that digital capacity can be acquired at $1000 more than voice interactive capacity, or voice and digital capacity for about $5500 over receive-only equipment.

The most comprehensive statement of goals for the interactive system is contained in a memorandum circulated internally on February 29, which updates material prepared by a task force on the problem during the late fall. Four general goals are stated: (1) to enhance student acceptance of "the entire school environment," "the total educational experience," "self," "the STD student program," "the interactive system," and "career education"; (2) to enhance the student's "acquisition of career-related knowledge"; (3) to motivate the student toward "learning," "acceptance," and "interactive participation," and (4) to "investigate the relative effectiveness of various interactive formats in enhancing acceptance and interactive participation." The general goals are subdivided into a five-page list of "specific audio interaction objective" which appear to be less an agreement on particular objectives than a catalog of many possible objectives.[10]

The specific objectives vary considerably in degrees of abstraction. The most precise are those which deal with "acceptance" and "user opinion regarding the degree of learning" associated with various interactive formats. Several are highly abstract, e.g., "to humanize a technological information delivery system by engaging students in personal communicative interaction," and "to enhance the self concept of students by accepting all interaction as being both relevant and important."

The last-quoted objective may be taken as a text to illustrate the conceptual problem which has faced the STD and which will face any organization attempting to rely on a large-scale two-way communications systems to stimulate educational communication.

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[10]The list is attached at the end of this paper.

"...accepting all interaction as being both relevant and important" could be understood simply as an operating rule meaning, "Every question or comment by a student deserves courteous attention, no matter how trivial or irrelevant it may sound." If so, it would mean, "Every student is important," and would be accepted in any humane system of values. If, however, it is taken literally, it amounts to a rejection of responsibility for the quality of what is communicated over a system. This is an appropriate attitude for a common carrier, but not for educators.

The STD has generally not attempted to relate the subject matter discussed during the two-way audio periods to material covered during the immediately preceding day or week. Questions from participating junior high schools during a given period follow no discernible pattern. The STD research records show that 75-80 percent are related to career education. The single largest caterogy (about 25 percent) is entrance on training requirements for specific jobs: e.g., "How much school does it take to be a forest ranger?" Almost 25 percent are related to the satellite and to STD program systems (e.g., compliments, production questions, suggestions), perhaps encouraged by several STD programs built around demonstration-related topics.*

It seems perfectly possible to develop interactive formats which stimulate exchange of information and ideas across distances, at least if the total number of participating classrooms is kept fairly small. Is it likely to be worth it?

The answer hinges on what one believes the role of the classroom teacher

*As this working paper was being prepared for final submission, the writer received a paper from the STD Research Component indicating higher learning gains at interactive sites than at receive-only sites. The data on which it is based is not yet available except in summary form.

should be.[11] (We are considering the public school situation, not the long-distance conference among doctors, administrators, or public safety personnel.) Advocates of televised instruction often argue that the medium can do some things better than all but a few teachers. Not just cheaper, but better. This may well be true.

For example, science demonstrations requiring more expensive equipment than low-income school districts can afford can be shown clearly and dramatically by television.

This line of argument rests on a distinction among teacher roles. It states that the role of purveyor of information can be performed as well, if not considerably better, by a film or videotape of a master teacher using multi-media resources skillfully. In this role, the technology-based approach offers the advantages of quality control to the producers and convenience to the users.

Considering the teacher in other roles--e.g., "facilitator," "encourager," "evaluator,"--there is no reason to believe that there are advantages in replacing a large number of small classrooms with one large one, which is what satellite-based interaction amounts to. It would be possible to seat thousands of public school pupils in a larger auditorium, with microphones placed around the floor for convenience in addressing questions to the podium or comments to others in the audience, after the manner of a large political

[11] There are, of course, other uses for two-way audio equipment than classroom teaching and even more uses for two-way teletype equipment. The value of such systems for essentially administrative purposes has to be assessed in different terms than those suggested here.

convention, and use the hall's public address sytem for "interaction." No one proposes to conduct classes like this, even in school's large enough to make it physically feasible. The situation does not change greatly when the groups clustered around the microphone happen to be physically remote from each other, except that the atmosphere is more orderly and less stimulating than a political convention.

The lecture hall analogy might suggest the best existing source of data on the problem of the relationship between useful interaction and audience size. It may be relevant for another reason, however. Participation in a large group, where some good questions are asked from the floor, can be stimulating. A recent televised address by Dr. Gerald Soffon, who is associated with the Viking-Mariner Mars probe, apparently generated excited questions. The STD broadcast the lecture during a time slot normally reserved for materials distribution to high school science students and others at the sites. Moreover, the lecture hall model faces up to the problem of teacher-pupil ratio, and decides it in favor of economy. The Appalachian portion of the present satellite demonstration accepted its logic to a considerable extent, since the site monitors at its fifteen classrooms are <u>not</u> content specialists, or even teachers. It seems unlikely in the public school situation that replacing classroom teachers with television is a probable development, however much talk that is about productivity.[12] Even getting teachers to

[12] Instructional television broadcasters to public schools have a delicate political problem in this regard. For obvious reasons, they can seldom be publicly critical of the quality of teaching in schools they expect to serve, but one's assessment of the value of "mediated instruction" depends mostly on how good one believes teaching would be in its absence.

relinquish primary reliance on the role of transmitting information seems difficult enough. Where the functions to be replaced are answering questions, encouraging a shy student to speak up, squelching a student who needs squelching, and generally guiding a discussion, the large technology-based components of an educational communications system are at an inherent disadvantage over its smaller human components.

It is important not to be romantic about this. It is not necessary to believe that most teachers have a great deal of factual information at their fingertips or that they are expert at leading class discussions. One may believe quite the contrary without being convinced that an "expert" panel in a broadcast studio, particularly the kind of talent that can be assembled repeatedly for live broadcasts, will do better.

To recapitulate: the mixed success of the two-way voice communication program of the STD, plagued by technical problems outside its operators' control, does not prove that such systems cannot be made to work well in public school situations. The existing arrangement, with all its problems, is popular among its users, at least as a free good. There is a problem of scale in planning future systems, which may become serious with relatively small audiences (i.e., of a few hundreds). The main question for educators, however, is, "Why should interaction take place via satellite among classrooms during time which could be spent on interaction within the classroom?" The present conclusion of this writer is that there is no good reason why it should.

Conclusion #2: Discussion

> Because of the scheduling and other disadvantages of having to view programs at the time they are broadcast, it seems likely that schools participating in future projects will wish to video-tape almost all tape and film materials for replaying at their convenience. Therefore, the most promising mode of satellite usage in American education appears to be some kind of "materials distribution service," but it remains to be seen whether this will be cheaper or more reliable than mailing out videotapes in the first place.

The problem local school principals and STD state coordinators have mentioned most frequently in conversations with the writer is scheduling. Local people appear to have been remarkably cooperative and willing to make adjustments for the sake of participation in the demonstration. School principals say matter-of-factly, however, that they had to build their schedules around the satellite broadcast times, and teachers note that if a school assembly or pep rally runs overtime for a few minutes, the first part of a lesson is simply lost. The satellite also transmits its lessons faithfully on days when school is closed by snow.

It seems clear that if a satellite-based system were used not for a single demonstration class, but for many classes, all schools would purchase videotape-recorders (VTR) and record broadcasts for replaying at their own convenience. This writer visited one STD site where two teachers were using the STD career education material, one as an official participant in the live demonstration, the other using tapes. Both seemed in general agreement about the content of the material, and found more to praise than dispraise. Both also felt that the second teacher was in the preferable position because of the added flexibility the use of tapes provided.

Unless the preceding section is wrong about the limited potential of "interactive" programming, it seems reasonable to expect that most future

programs via satellite will be videotaped at the receiving site, except where it is equally convenient to view them live and there is no reason to preserve a program. This presumably would also be true for series like "Time Out," since their being produced and transmitted by the same organization should make no difference to the user.

Starting from these assumptions, the operating details of the STD's "Materials Distribution Service" are of particular interest. The STD is preparing detailed documentation of how the service has functioned, and for the present a brief description will suffice.

Teachers (at either receive-only or interactive sites) may use the service to order films on any subject, which have been free during the demonstration year. The decision to transmit an item is based on demand. Three or four requests have usually been enough to get an item transmitted, and the STD staff says that a teacher usually learns in two or three weeks whether his request will be sent. The service is not dependent on special broadcast hours, so long as broadcast time can be communicated to schools in advance. Materials can be sent out at off hours (e.g., 2 a.m.) and recorded at the school by a VTR equipped with a timer or station-activated switch.

During the first semester the service sent over two hundred films out to participating schools. The records of the Research Component, the reports of State Coordinators, and conversations with state and local people indicate that the service is extremely popular.

Again, the difficulty of assessing its long-range popularity is that, so far, the films have been free. The schools paid for their own VTRs (about $1350) and must pay for blank tapes (about $30 per hour). The films are leased to the STD from the Great Plains National Institutional Library, a

distributor of film materials; from Brittanica Film Corporation, a commercial producer, and from various other distributors. At the end of the demonstration year, the agreement requires the schools either to erase their tapes or to buy them at about one-third catalog price. There seems to have been some early misunderstanding among schools about the terms of the agreement, and at least two State Coordinators say that school officials originally believed that they would be permitted to keep all tapes indefinitely.

Negotiating agreements on distribution and copying privileges on films and tapes might be the most difficult aspect of setting up a large-scale distribution system via satellite. Until the details of such an agreement were firm, cost estimates of the system would be incomplete, particularly from the user's viewpoint. The copyright problem has even arisen within the "Time Out" series, most of which was produced directly by the STD. The Federation incorporated segments of commercial films into a number of programs, mostly showing people at work at their jobs. The "job clips" have been perhaps the best received portions of the series. The film segments were leased from commercial suppliers, and as late as March there was some doubt as to whether they would continue to be free to all users, even though the series as a whole was produced with public funds.[13]

The question which naturally arises is whether transmission of films and tapes via satellite is cheaper than sending them by mail. This paper will not attempt to answer the question, but it seems the right focus for a comparative cost study.

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[13] This problem reportedly has been resolved by trading substantial quantities of tape stock for rights to almost all film segments. Details of the settlement have not been verified and are of no particular relevance here.

Scheduling problems would not vanish entirely, of course, in a large-scale operation. The STD materials distribution service has transmitted single films, giving some preference to shorter films in order to satisfy more teachers. (Average film length in the first semester was about 17 minutes.) If a few schools wished to use an 80-lesson film series, such as a videotaped language course, the competition for scarce broadcast time would be severe, as long as a 30-minute film took 30 minutes to transmit. Technical breakthroughs in compressing films for transmission could change the present cost situation drastically, just as increased use of video discs could lower the losts of conventional distribution. In the interim, it is unknown whether enough schools would want the same material to justify the costs of aggregating demand for satellite distribution. Market research specifically addressing that issue seems feasible, however, should the issue arise in planning future systems.

In short, the cost question is still unanswered, but its parameters seem definable. The biggest uncertainty may be the copyright issue. The point of this short discussion is not to argue that some form of materials distribution via satellite is necessarily desirable, but that it is a function where the satellite's capacity for wide-area coverage could be exploited in public education while avoiding some of the scheduling problems of real-time reception. It is using the technology-based portions of the system where they have the best chance to appear at an advantage over the other alternatives. Technological ingenuity can be directed toward eliminating external problems, not those created by the system itself.

ATTACHMENT I

Profile of the Satellite Technology Demonstration
EPRC/SURC "Quarterly Report on the Educational Policy Research Center's Education Satellite Policy Analysis Project," January 10, 1975)

The Satellite Technology Demonstration (STD) is the largest component of the Education Satellite Communications Demonstration, broadcasting color television programs via NASA's ATS-6 Satellite directly to 56 rural schools ("closed" sites) and through 12 public television stations ("open" sites). Programs are designed for three groups: junior high school students, teachers, and adult evening audiences. Its sponsor is the Federation of Rocky Mountain States, a Denver-based organization with public and private sector membership from Colorado, Idaho, Montana, New Mexico, Utah and Wyoming. The STD also broadcasts to Arizona and Nevada.

The STD broadcasts in four formats:

(1) "Time Out," a sixteen-week series of daily programs on career development for junior high school students, is the principal product. It reaches about 1500 students at the 56 rural schools and several thousand in the public television receiving areas.

(2) "Careers and the Classroom--A New Perspective for Teachers," is a bi-weekly, year-long inservice series on career development for public school teachers.

(3) "Footprints" is a series of ten topical evening programs for general community viewing.

(4) A materials distribution service transmits films leased from a commercial film library for videotaping and later use by schools.

"Time Out," in which time-travelers from the future study career choices in the 1970s, includes four days of 29 minutes on tape followed by 6 minutes of "live interaction" with the 24 rural sites with two-way audio equipment. On Fridays, the entire program is transmitted live. Video and sound quality over ATS-6 has been excellent, but voice communication during the interaction periods, which is carried by the older ATS-3 satellite, has generally been unintelligible except to studio monitors.

The first planning grant to the STD came from USOE in 1971. Since then the project has received a total of about $10 million, about $1.4 million of which went to plan an early childhood series which was later dropped. The budget in FY1974 was about $3,850,000,of which about $2,460,000, went toward programs production. During the first half of FY1975 the STD spent just under $1,800,000, of which $500,000 went for production.

The STD's early history is summarized in a study by the Stanford University Department of Communication.* The period before FY1974 was characterized by considerable turmoil, complicated by shifting responsibility for project direction among Federal agencies. A major conclusion of the Stanford study is that there was "a mismatch in expectations between Federal and on-site planners." In June, 1973, the new director, Dr. Gordon Law, who had previously headed the STD's Broadcast and Engineering Component, negotiated a memo of understanding with the present Federal sponsor, the National Institute of Education, containing the following statement of objectives:

(1) To demonstrate the feasibility of a satellite-based media distribution system for isolated rural populations.

(2) To test and evaluate user acceptance and the cost of various delivery modes using a variety of materials.

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*Nancy H. Markle and David G. Markle, History and Recommendations Resulting From Evaluation Planning for the Federation of Rocky Mountain States' Educational Technology Demonstration, Final Report on Contract No. HEW-OS-72-155, May 10, 1974.

Broadcasts of "Time Out" began on September 9, 1974, and other formats followed on schedule. Some editing in response to audience reaction during the first semester preceded the second semester broadcasts, which began on January 20, 1975.

The STD is collecting large quantities of acceptance data in the form of questionnaires and has administered parts of the Career Maturity Inventory test package at the beginning and end of each semester. Measurements of learning were not required to meet Federal goals, but were added at the urging of state and local school officials.

ATTACHMENT II

STD Goals and Objectives

STD Audio Interaction Goal

The STD Interaction Goal was specified in such a way as to compliment the present STD goals stated in conjunction with NIE.

GOAL: To provide information for future decision-makers, relative to the utilization of Satellite Interactive Systems, by collecting, analyzing, and interpreting data regarding:

1. The feasibility of a satellite interaction system, which is one element of a satellite-based media distribution system for rural-isolated audiences.

2. User acceptance, user benefits, and the cost of various delivery modes using a variety of interaction formats.

General Audio Interaction Objectives

The following general audio interaction objectives were specified solely for student interaction, and in no way reflect the cost aspect of the above goals. The latter is within the realm of another study.

I. To enhance the student's acceptance of:

   a. the entire school environment
   b. the total educational experience
   c. self
   d. the STD student program
   e. the interactive system
   f. career education.

II. To enhance the student's acquisition of career-related knowledge.

III. To motivate the student toward:

   a. learning
   b. acceptance
   c. interactive participation

IV. To investigate the relative effectiveness of various interactive formats in enhancing:

   a. acceptance
   b. interactive participation

Specific Audio Interaction Objectives

In order to provide specific guidance for the specification of program formats, The following specific interaction objectives were defined for each of the above General Objectives.

I.A.To enhance the student's acceptance of the entire school environment and the total educational experience.

Specific Objectives

1. To humanize a technological information delivery system by engaging students in personal communicative interaction.

2. To incline the student toward viewing the school environment as being responsive to him as both a person and a learner, by providing:

   a. in so far as possible, immediate verbal responses to interactive comments, requests, questions, etc.

   b. when necessary, delayed verbal responses to interactive comments, requests, questions, etc.

   c. when necessary, written responses to interactive comments, requests, questions, etc.

   d. the career education teachers with that information, aid, etc, requested via the interactive system (student or inservice).

3. To dispose the student toward attempting to impact on his school environment through the utilization of the decision-making process, by responding to questions regarding such, in a way designed to:

   a. encourage the student to make his own decisions.

   b. focus on decision-making.

   c. clarify values, alternatives, goals, etc.

4. To provide students with opportunities to interact with STD staff and "visiting experts" regarding:

   a. the relationship between junior and senior high experiences and career decision-making.

   b. the relationship between specific courses of study (both chosen and required) and career decision-making.

   c. the relationships among (a) the development of and changes in his own personal characteristics (i.e. values, interests, etc); (b) the learning environment; and (c) career decision-making.

   d. the relationship between education in general and life style, etc.

I.B. To enhance the student's acceptance of self.

Specific Objectives

1. To enhance the self concept of students by accepting all interaction as beinb both relevant and important.

I.C. To enhance the student's acceptance of the STD student programs.

Specific Objectives

1. To provide students with opportunities to actively participate in both programs and program-related decision-making processes by allowing them to utilize the interactive system for:

   a. discussions and decision-making relative to the production of their own programs.

   b. expressing individual and/or group opinions about pre-taped program, support materials/activities, the STD-produced live interaction programs.

   c. suggesting possible changes in the content and format of pre-taped programs, support materials/activities, the STD-produced live interaction programs.

   d. soliciting information regarding various aspects of the STD such as: (1) the information presented; (2) the production of programs/segments; (3) the satellite delivery system; (4) the various STD occupations involved; (5) the purposes and goals of the programs and the STD in general; and (6) the changes which have resulted from their input.

I.D. To enhance the student's acceptance of The Interaction System.

Specific Objectives

1. To increase the perceived relevancy of the interactive system for both individuals and sites by providing opportunities for both students and site personnel to actively participate in:

   a. hardware and equipment operation.

   b. interactive discussions regarding all aspects of the STD products and services.

   c. the decision-making process relative to the actual use of the interactive system itself.

2. To provide a means for the immediate reporting of intra-program reception or understandability problems (i.e. video or audio problems, requests for the repetition of information or explanation of information, etc.).

I.E. To enhance the student's acceptance of Career Education.

Specific Objectives

1. To provide students with opportunities to interact with persons whose life experiences clearly illustrate the concept of career development (i.e. education), as a life-long learning process, encompassing all human experience both within and without the traditional learning environment.

II. To enhance the student's acquisition of career-related knowledge.

Specific Objectives

1. To individualize the learning process by providing students with opportunities to interact with both the STD staff and visiting experts and thereby solicit information and/or opinions regarding:

   a. Careers of personal interest, including such information as:

      (1) work performed.
      (2) physical demands.
      (3) working conditions.
      (4) education and training required.
      (5) aptitudes, interests, and temperament associated with.
      (6) future outlook/possibilities.
      (7) salary ranges.
      (8) possibilities for advancement.
      (9) self employment.
      (10) mobility.

   b. A variety of post-secondary options, including:

      (1) colleges and universities.
      (2) community and junior colleges.
      (3) vocational/technical schools.
      (4) armed services.
      (5) apprenticeships.
      (6) on-the-job training.

   c. The information disseminated via the pre-taped Time Out series, i.e. steps in the decision-making process, vocabulary, etc.

   d. Personal career decision problems.

2. To provide interested "groups" of students with opportunities to request information about:

   a. the STD programs.
   b. careers in general.
   c. career availability in other STD sites.

3. To encourage self assessment, the utilization of the decision-making process, and the acceptance of responsibility for decision-outcomes by:

   a. subtly refusing to make decisions for students (i.e. interactive "what to do" questions) but instead using such requests as opportunities for:

      (1) posing questions to students which help clarify values, alternatives, goals, etc.

      (2) stressing the need for self-assessment, information gathering, consideration of alternatives, etc.

   b. providing students with opportunities to question people about their career decisions and resultant outcomes.

   c. providing students with opportunities to participate in the decision-making process, by aiding in their solicitation of information (a decision-making step).

   d. accepting all student efforts to gather information via the interactive system as relevant and important.

4. To enhance the concept of human growth and development by indicating ways in which people change (i.e. people acquire and refine characteristics through experience and decision-making processes).

III.A. To motivate students/teachers toward learning.

1. During specified periods of program interaction, the students/teachers will:

   a. participate in interactive discussions for the purpose of reinforcing or enriching the learning process relative to the attainment of program objectives.

   b. solicit information regarding additional areas of learning which are made relevant by the nature of the STD, itself, (i.e. satellites, communications technology, T.V. film or live production, T.V. technology, etc.).

III.B. To motivate students/teachers toward Acceptance.

1. Across time and at project conclusion, the students/teachers will express agreement/satisfaction and/or enthusiasm relative to each of the following:

   a. relevant pre-taped programs.
   b. Materials Distribution Service.
   c. student support materials.
   d. interactive programs.
   e. STD support of local efforts.
   f. STD response to site requests/suggestions/criticisms.
   g. continuance of a - f above.
   h. expansion of a - f above.

III.C. To motivate students/teachers toward Interactive Participation.

1. Across time, requests will occur relative to a desired increase in:

   a. time allotments for interaction.
   b. amount of interaction.

2. Across time, and at project conclusion, intensive students/teachers will indicate agreement or satisfaction with:

   a. a continuance of the interactive system.
   b. an expansion of the interactive system.

3. Across time and at project conclusion, the ROT teachers/students will express a desire for participating in the interactive system.

IV. A. To investigate the relative effectiveness of various interactive formats in enhancing learning.

1. To assess user opinions regarding the degree of learning which occurs with each of the following interactive formats.

   a. The 6 minute "Time In" Format (i.e. strictly Career Ed. oriented).

   b. The 30 minute format involving only STD staff members.

   c. The 30 minute format involving visiting experts, selected on the basis of user input.

   d. Formats devised, decided upon, and produced by the students/ teachers themselves.

IV.B. To investigate the degree to which the intensive sites utilized the Interactive System in conjunction with each of the following formats.

   a. The 6 minute "Time In" Format (i.e. strictly Career Ed. oriented).

   b. The 30 minute format involving only STD staff members.

   c. The 30 minute format involving visiting experts, as suggested by the sites themselves.

   e. Formats devised, decided upon, and produced by the students/ teachers themselves.

IV.C. To investigate the type of interaction which occurs in conjunction with each of the previously described interaction formats (A and B above).

IV.D. To investigate the degree of relevancy attributed to each of the previously described interaction formats (A and B above) by each of the system participants.

STUDENT AUDIO INTERACTION FORMATS

In order to accomplish the preceeding specific objectives, the following formats have been devised for "Time In" and "Time for You."

Daily Live Interaction: "Time In"

To facilitate better utilization of the daily 6:10 live interaction and to increase its total educational value as well as accomplish many of the previously stated objectives, the following changes have been made to the "Time In" segment. These modifications should encourage ITs and ROTs alike to stay tuned to this segment in order to gather additional occupational information. The "Occupation of the Day" segment can be successfully presented regardless of the VHF quality of the day.

The modifications are:

1. Format

@ 28:50	Live interaction with Helen relative to student Career Ed. Questions.	5:00
@ 33:50	Slide and introduction to "Occupation of the Day" with Helen.	00:10
@ 34:00	Printed "Occupation of the Day" with "My Rocky Mountains" as background music.	01:00
@ 35:00	To Black	

2. Orientation

To better prepare the audience for "Time In" participation, the daily 6:10 for the week of January 20, 1975 will be used to orient the audience. The areas to be covered are:

a. Format clarification
b. Microphone Discipline
c. Introduction to the DOT.

Helen will serve as the program moderator for the series, but will not appear daily during the first week. Broadcast and Engineering personnel and Al McWilliams will introduce themselves and make brief presentations to the audience on three days of the week.

The "Time In" schedule for January 20 - 24 is:

Monday: Helen and Karen
Introduce selves and format. Prepare audience for next day's orientation.

Tuesday: Broadcast and Engineering
Prepare audience for VHF situation and instruct for proper microphone usage.

Wednesday: Helen and Karen
Reinforce microphone usage instruction. Practice with a few sites. Reiterate format and specifically introduce daily one minute "Occupation of the Day" segment. Emphasize need for DOT in classroom on the next two days and available for daily usage for remainder of semester.

Thursday: Al McWilliams
1st orientation to the DOT

Friday: Al McWilliams
2nd Orientation to the DOT and its applicability to the "Occupation of the Day" segment. Re-introduce Helen and Karen who'll prepare the audience for Monday.

All of the orientation sessions will have varying amount of question/answer live interaction depending on the instruction time needed.

3. Occupation of the Day

Each day during "Time In" ten or more occupational titles with or without their corresponding COT code n-mbers will be presented to the audience. The purpose of this is to expose them to various occupational names and to encourage the exploration of these occupations utilizing the DOT. When specific occupational categories are covered during the Time Out program, the titles presented in "Occupation of the Day: will correspond with the day's category. On days when no occupational category is discussed, the titles presented will be selected randomly. All selections will be made by content personnel.

This daily presentation should cause involvement on the part of all sites regardless of IT or ROT, called upon or not, quality of audio or VHF. It should also encourage learning about and using the DOT.

Friday Live Interaction: "TIME FOR YOU"

The following Friday Live Interaction Formats: "Time for You", for the second semester have been specified as follows. This specification was based on suggestions and requests gathered from the sites during the first semester. User-input data has been supplemented by in-house suggestions from Management, Programming, Research, and Utilization Components.

Schedule

2-14-75 (J76) Knowledge Pool - Jerry Vondergeest.

2-28-75 (J20) Broadcast and Engineering Present Basic Information regarding: Satellite, Delivery System, Ground Terminals, etc.

3-7-75 (J35)	Studio Production Engineer Personnel and Physical Studio
3-14-75 (J39)	Post-secondary Options: Representative from 4-year college or University.
3-21-75 (J44)	Post-secondary Options: Representatives from Junior College
4-4-75 (J49)	Post-secondary Options: Representatives from vocational/technical schools.
4-11-75(J61)	Post-secondary Options: Representatives from Apprenticeship program/union.
4-18-75 (j61)	Post-secondary Options: Representatives from Military Services.
4-25, 5-2, 5-9 (J66, J71, J76)	Open for Site Use.
5-16-75	Wrap up.

Open Fridays

As shown in the schedule, three friday programs have been described as Open. This action was taken in order to provide the means for accomplishing the following previously stated objectives:

I.C. To enhance the student's acceptance of the STD student programs.

1. To provide students with opportunities to actively participate in both programs and program-related decision-making processes by allowing them to utilize the interactive system for:

a. discussions and decision-making relative to the production of their own programs.

I.D. To enhance the student's acceptance of the Interactive System.

1. To increase the perceived relevancy of the interactive system for both individuals and sites by providing opportunities for both students and site personnel to actively participate in:

c. the decision-making process relative to the actual use of the interactive system itself.

IV.A. To investigate the relative effectiveness of various interactive formats in enhancing learning.

IV.B. To investigate the degree to which the intensive sites utilize the interactive system in conjunction with various formats.

IV.C. To investigate the type of interaction which occurs in conjunction with each of various interaction formats.

IV.D. To investigate the degree of relevancy attributed to each of various interaction formats.

In order to accomplish the above objectives, the STD is presently decentrallizing the decision-making process relative to the Three Open Fridays. The sites will be assuming this responsibility and utilizing the ATS-3 Interaction System for decision-making processes and planning activities relative to program topics, formats, utilization of the interactive system during the program, etc.. The role of the STD will primarily be one of support and assistance as requested by the sites themselves.

GENERAL ASSESSMENT TECHNIQUES

The accomplishment of the previously stated objectives will be assessed using the following techniques:

1. Analysis of the "Type of Interaction."
2. Analysis of the "Content of Interaction."
3. The solicitation of opinion data from both Teachers and Students.
4. Through the utilization of the student research design, i.e., comparing ROT to Intensive to Open.

APPENDIX B

WORKING PAPER ON ESCD COSTS

1. Introduction and Summary

This working draft is the initial analysis of cost data collected from the ESCD. Data for the thirty month period from July, 1972 to December, 1974 provided by the Federation of Rocky Mountain States forms the nucleus of the present analysis. As more data is collected from FRMS, the Appalachian portion of the demonstration, and the Alaskan portion, they will be included in the analysis. This paper sets out to describe the expenditures made by the FRMS/STD group and to make preparations for generalizing about the costs of future possible educational materials and services distribution systems.

There are five sections to this paper plus an Appendix. The second section describes the FRMS/STD data per se, while the third describes how it was organized by functional cost area--an attempt to gain insight into how the various activities necessary for the overall operation of the system effect costs. The fifth section tries to put the analysis into perspective and makes suggestions for further study.

The FRMS cost data was readily adaptable to the needs of this analysis; the format of the FRMS accounting system allowed for the grouping of expenditures under five categories: Technical, Production, Management, Utilization, and Research and Evaluation. Table 1.1, Summary of Expenditures, FRMS/STD, contain some of the results of the analysis. Excluding expenditures by FRMS previous to Federal fiscal year 1973,* the production of programming accounted for over 30 percent of total expenditures in each time period. The Broadcast

*As yet, this data is unavailable.

and Engineering or Technical portion of total costs was relatively low in FY73 but was over 30 percent for FY74 and the six months of FY75. The gain in the share of Technical costs can be attributed to the increased expenditures for capital in that department (see Tables 1.2 through 1.4).

There was a large drop in the relative share of costs attributed to Management between FY73 and FY74. Also, the cost share of Utilization dropped. The creation of the new department, Research, by FRMS helps explain the drops. The research and evaluative function had been performed by persons in different departments, especially by the Utilization staff. Since cost shares are interdependent and Technical costs increased so much, other shares would naturally fall. In this light, Utilization expenditures are basically stable.

Besides breaking down costs by the five departments, FRMS classified expenditures by ten categories. Graph 1.1 illustrates the importance of the expenditure category Personnel Compensation, as salaries and benefits significantly contributed to costs for all five functions in fiscal year 1975. The most relatively capital intensive function was Technical, and Capital Expenditure was also important to the Production cost area. The "Other" expenditure categories are Transportation, Meetings, Rent and Utilities, Print and Duplication, Communications, Sub-contract, General and Administrative, and Indirect Costs. A more detailed breakdown of costs by expenditure category for fiscal years 1973, 1974 and 1975 is found in Tables 1.2, 1.3, and 1.4. Generally, Personnel Compensation was the category with the largest share of total expenditures, and, except for FY73, Capital Expenditure was second.

The cost and expenditure categories are discussed in more detail in the following two sections. A more complete description of the results of the analysis is in Section 4.

TABLE 1.1

SUMMARY OF EXPENDITURES FRMS/STD

Cost Category	7/72-6/73 Cost in $	% Total FY73	7/73-6/74 Cost in $	% Total FY74	7/74-12/74 Cost in $	% Total FY75	7/73-12/74 Cost in $	% Total 7/73-12/74	7/72-12/74 Cost in $	% Total 7/72-12/74
Technical	321,390	15.10	1,173,619	30.46	645,358	35.86	1,818,977	32.18	2,140,367	27.51
Production	651,757	30.45	1,395,204	36.21	504,885	28.05	1,900,089	33.61	2,551,846	32.79
Management	644,782	30.28	644,205	16.72	249,989	13.89	894,194	15.82	1,538,976	19.78
Utilization	514,846	24.18	429,814	11.16	273,580	15.20	703,394	12.44	1,218,240	15.66
Research & Evaluation	---	---	210,054	5.45	125,891	7.00	335,945	5.94	335,945	4.32
Totals:	2,129,051	100.03	3,852,906	100.00	1,799,710	100.00	5,652,616	99.99	7,781,667	100.06

Table 1.2

COST DATA SUMMARY FRMS/STD

Fiscal Year 1975[a]

Expenditure Category[b]	Cost Centers (Figures in dollars)					Total Cost in $	Percent Total FY75
	Technical	Production	Management	Utilization	Research & Evaluation		
Personnel Compensation	224,619	300,943	95,739	94,023	68,265	783,592	43.54
Transportation	41,301	4,850	14,292	14,887	6,800	82,132	4.56
Meetings	467	60	2,539	7,362	---	10,429	0.58
Rent & Utilities	16,995	24,935	7,928	7,790	5,650	63,309	3.52
Print & Duplication	225	11,620	15,207	---	4,620	31,672	1.76
Communication	12,091	71	6,885	4,273	1,116	24,436	1.36
Sub-contracts	27,375	35,495	---	112,190	11,274	186,334	10.35
General & Administrative	17,180	11,162	42,933	2,332	6,371	79,978	4.44
Capital Expenditures	233,133	25,011	8,484	---	---	266,628	14.82
Indirect Costs	71,972	90,736	55,977	30,720	21,794	271,200	15.07
TOTALS:	645,358	504,885	249,989	273,580	125,891	1,799,710	100
Percent Total FY75:	35.86	28.05	13.89	15.20	7.00	99.98	

[a]Fiscal Year 1975 is for a six month period, July/74-December/74.

[b]Expenditure categories and cost centers are explained in the accompanying text.

Table 1.3

COST DATA SUMMARY FRMS/STD

Fiscal Year 1974

Expenditure Category[a]	Cost Centers (Figures in dollars)					Total Cost in $	Percent Total FY74
	Technical	Production	Management	Utilization	Research & Evaluation		
Personnel Compensation	326,141	482,030	181,310	198,439	139,955	1,327,877	34.46
Transportation	67,910	15,198	40,468	24,874	6,264	154,714	4.02
Meetings	455	34	1,452	393	352	2,687	0.07
Rent & Utilities	35,672	57,793	21,738	23,792	16,778	155,774	4.04
Print & Duplication	---	3,762	23,722	100	1,861	29,446	0.76
Communications	5,841	822	7,873	6,031	423	20,992	0.54
Sub-contracts	26,485	385,488	170,874[b]	116,035	---	698,882	18.14
General & Administrative	29,974	46,578	71,359	2,149	5,513	155,575	4.04
Capital Expenditures	571,589	259,447	21,362	---	313	852,713	22.13
Indirect Costs	109,552	144,052	104,044	57,997	38,592	454,239	11.79
TOTALS:	1,173,619	1,395,204	644,205	429,814	210,054	3,852,906	99.99
Percent Total FY 74:	30.46	36.21	16.72	11.16	5.45	100	

[a] Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[b] This figure includes expenditures for Early Childhood Education and will be deleted from future analysis of this type.

Table 1.4

COST DATA SUMMARY FRMS/STD

Fiscal Year 1973

Expenditure Category[a]	Cost Centers (Figures in dollars)				Total Cost in $	Total FY73
	Technical[b]	Production	Management	Utilization		
Personnel Compensation	149,079	331,958	187,316	264,229	931,958	43.77
Transportation	36,992	52,962	67,350	39,967	197,272	9.27
Meetings	386	3,159	1,175	1,370	3,159	0.15
Rent & Utilities	19,817	44,118	24,895	35,113	123,856	5.82
Print & Duplication	48	159	30,447	34	30,689	1.44
Communications	411	187	36,279	112	36,989	0.17
Sub-contracts	---	118,667	---[c]	93,932	212,599	9.99
General & Administrative	15,745	2,928	75,445	2,928	97,045	4.56
Capital Expenditures	48,247	670	91,905	---	140,742	6.61
Indirect Costs	50,665	96,949	129,568	77,160	354,742	16.66
TOTALS:	321,390	651,757	644,782	514,846	2,129,051	98.44
Percent Total FY73	15.10	30.45	30.28	24.18		

[a]Expenditure categories and cost centers are explained in the accompanying text.

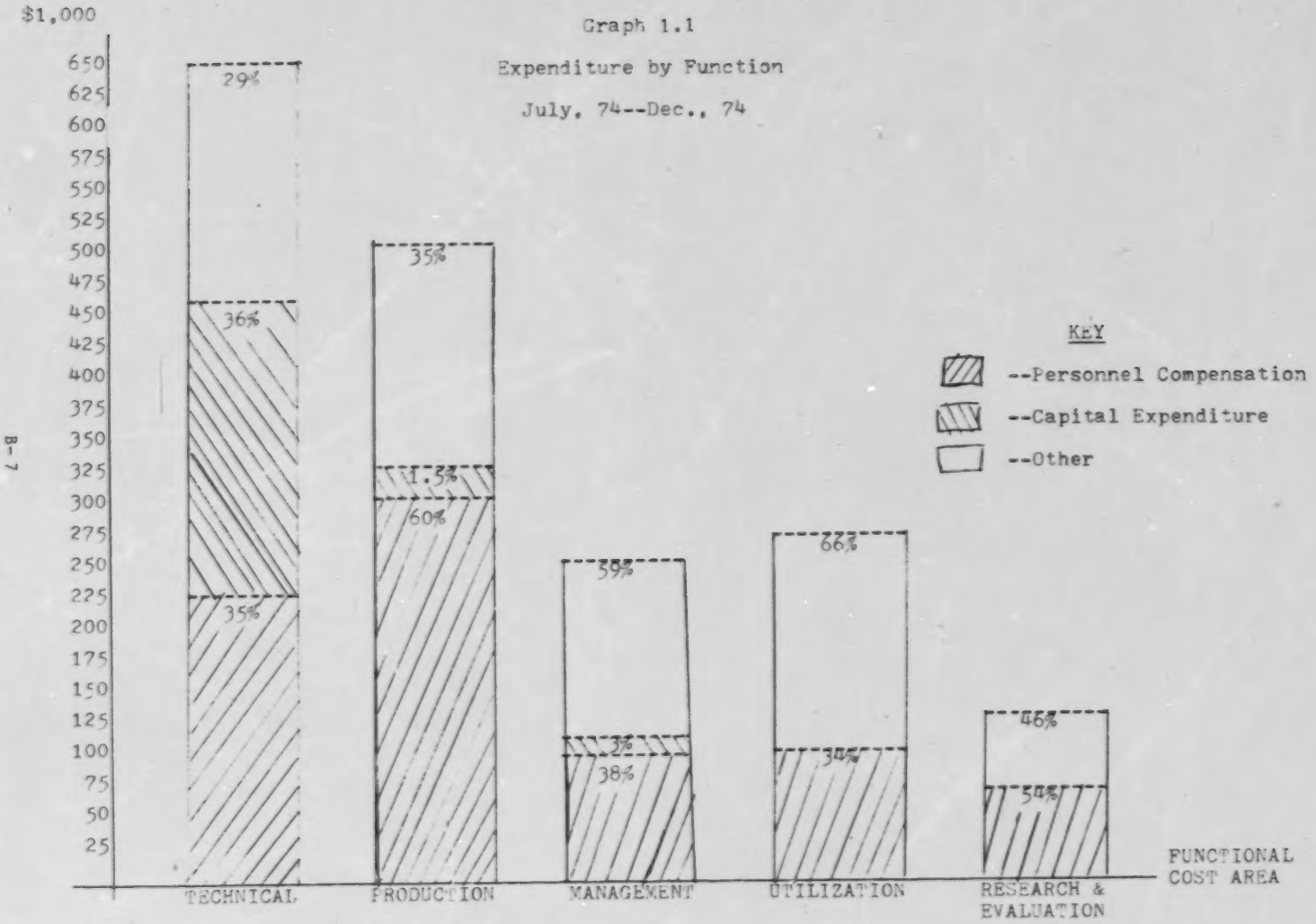
[b]Only for November/72-June/73.

[c]A figure of $1,265,746, a grant for Early Childhood Education is excluded because it distorts the remaining figures.

Graph 1.1

Expenditure by Function

July, 74--Dec., 74



2. The FRMS/STD Data

Basically, the cost centers reflect functional cost-incurring areas; that is, they correspond to productive activities engaged in by the FRMS/STD. Also, they were delineated in order to monitor certain components of total cost. For this reason, the categories Programming and Program Talent were kept separately by FRMS; for our purposes, both can be included in the category Production. To facilitate the cost analysis, several of the FRMS/STD designated cost centers were consolidated into aggregated cost centers. These consolidations are described in the next section.

The ten expenditure categories used by FRMS were considered appropriate for this cost analysis and were maintained intact.

Several things should be kept in mind when evaluating the data used in this cost analysis and when reading the analysis itself. First, there is an element of arbitrariness in assigning expenditures to a functional area. The areas are based upon definitions which are often open to interpretation, and the inclusion of an expenditure in one center as opposed to another may not entail a clear-cut decision. Assignments made at different times are especially apt to be inconsistent. This is something which simply cannot be helped. Second, the specification of a new cost center may change the allocation of costs to all categories. For example, the delineation of the cost center Research and Evaluation in July, 1974 means expenditures that were previously included under Utilization or Production but served research or evaluative functions would now be included in the Research and Evaluation cost center. Special care must be taken when making comparisons between FY73 and subsequent years. Table 2.1 summarizes the year by year designation of cost centers by FRMS.

Table 2.1

COST CENTERS

Fiscal Year 1973	Fiscal Year 1974	Fiscal Year 1975
Broadcast and Engineering	Broadcast and Engineering	Broadcast and Engineering
	Receive Only Terminal Retrofit	Receive Only Terminal Retrofit
	Denver Uplink Personnel	
	Equipment and Facilities	Equipment and Facilities
Production	Programming	Programming
	Program Talent	Program Talent
Career		
Administration	Administration	Administration
		Public Information
	Research	Research
	Data Processing	
Utilization	Utilization	Utilization

EXPENDITURE CATEGORIES: Personnel Compensation, Transportation, Meetings, Rent and Utilities, Printing and Duplication, Communications, Sub-contracts, General and Administrative, Capital Expenditures, and Indirect Costs.

3. Organization of the FRMS/STD Data

The analysis of the FRMS/STD cost data proceeds by tabulating expenditures by functional cost areas. Five areas are defined: Technical, Production, Management, Utilization, and Research and Evaluation. Basically, these five areas are consolidations of some of the cost centers delineated by FRMS. The Management, Research and Evaluation, and Utilization categories are self explanatory. Technical refers to the costs incurred by broadcasting and receiving signals via satellite. Production encompasses the costs of developing and renting programming for the ESCD. The consolidation of the ten FRMS/STD cost centers into the five functional cost areas used in the analysis is schematically depicted on the following two pages.* The single most difficult task of the consolidation was the splitting of the costs listed under Equipment and Facilities into components of the Technical and Production categories.

Assigning particular expenditures from the FRMS Equipment and Facilities cost center to the Technical or Production functional cost area required judging whether an expenditure best fit into one functional category or another. Information provided in conversations with personnel at FRMS aided the reallocation procedure. Still, this decision process was somewhat inexact. For example, expenditures under Equipment and Facilities were made for video tape machines, but the machines were employed for use in both Technical and Production capacities. In reassigning costs, some error crept in, but its magnitude is not great enough to distort the results.

In another instance, costs had to be reallocated. Rent and Utilities expenditures were charged to only two categories, Technical and Management.

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*Because of the nature of the FY73 data, no elaborate modifications were necessary with the respect to cost categories. Only the category Career was added into Production for the analysis. Also note that there was not separate Research and Evaluation cost area in FY73.

This resulted in a distortion of relative cost shares between cost centers. The Rent and Utilities charged to Management had to be reallocated among Utilization, Research and Evaluation, Production, and Mangement. Personnel compensation expenditures were used as a weight and were subjectively selected. Other figures which might have been used as a basis were either not available or were no more justifiable.

The following subsections detail the procedures used in reallocating Equipment and Facilities and Rent and Utilities. The working tables in the appendix summarize the consolidations.

Table 3.1

CONSOLIDATING COST CENTERS: FY75

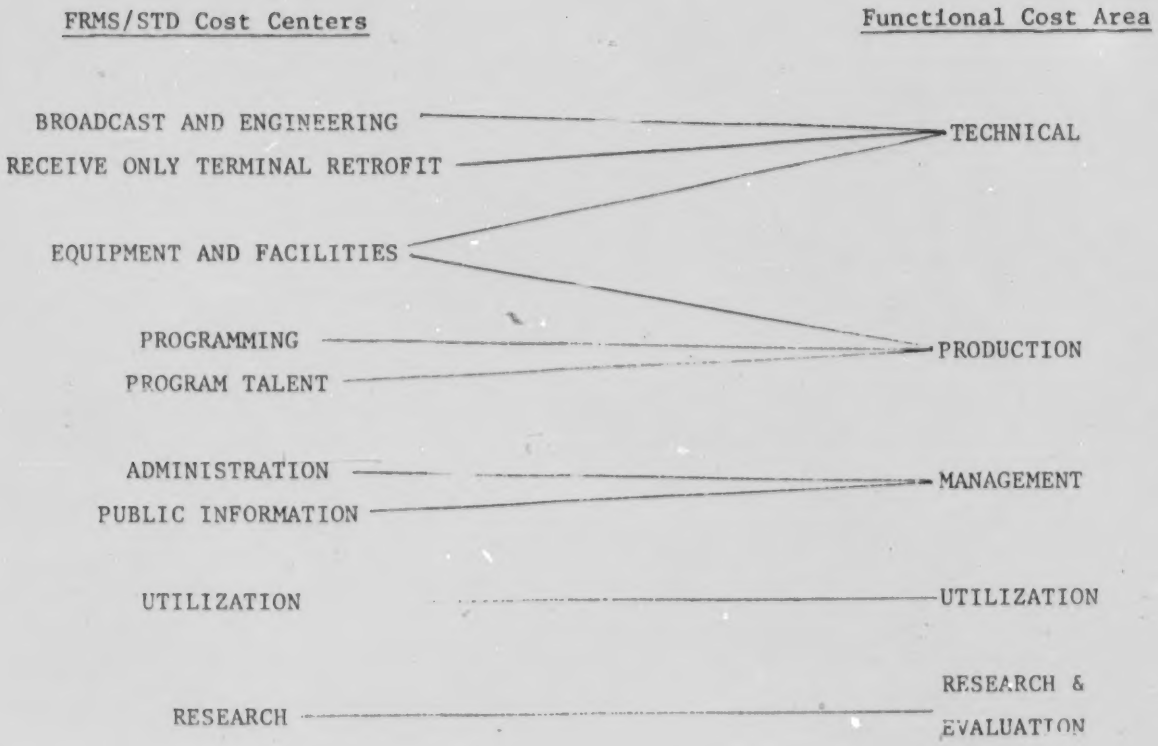
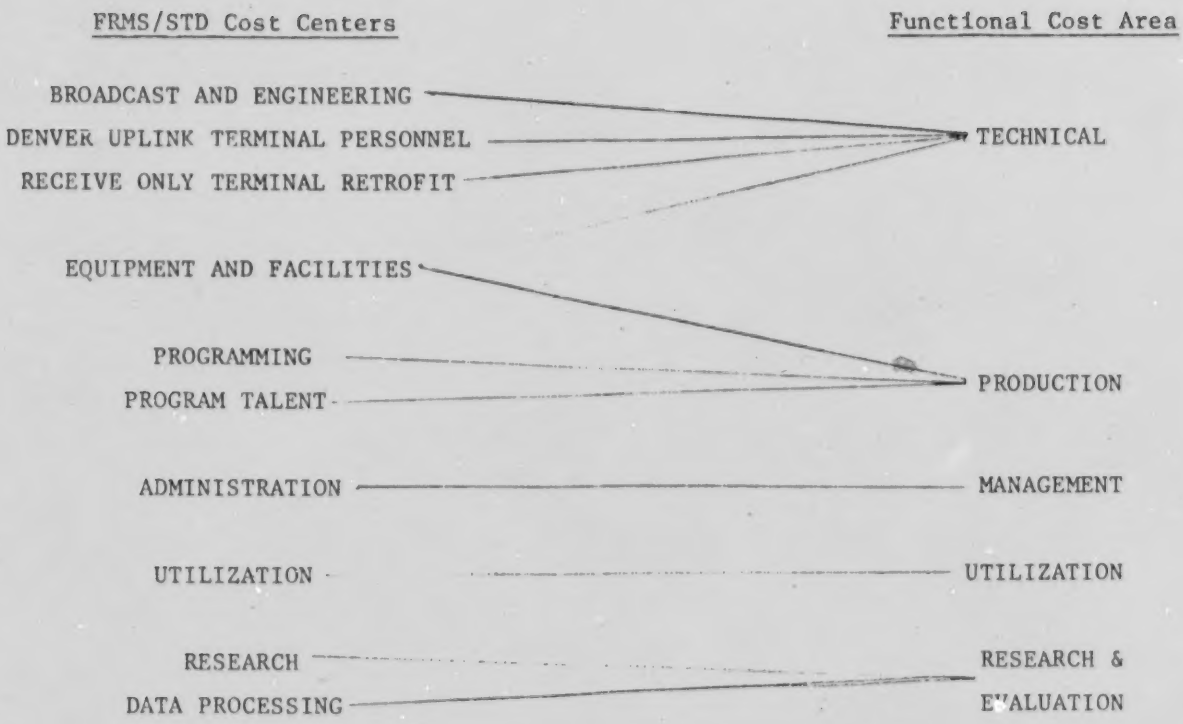


Table 3.2

CONSOLIDATING COST CENTERS: FY74



3.A Equipment and Facilities Reallocation

As noted earlier, the reassigning of expenditures of either Broadcast and Engineering or Program was accomplished by determining the function served by the goods or services which were purchased. Most of the expenditure categories were related to Broadcast and Engineering (the Technical function).

Under the expenditure category sub-contracts, a split between Technical and Production was required. The FRMS sub-category Studio/Access Redundancy Sys refers to video tape machines used by PBS for the delay broadcast of programs. Studio Equipment Lease refers to machines used in the creation of programming. Actually, all the tape machines tend to be used on a "what's available" basis, but the formal breakdown was maintained.

The General and Administrative expenditure reflects purchases for both cost categories. Additional information was provided by FRMS which resulted in the figures given in the tables.

The breakdown listed under Capital Expenditures is fairly self-explanatory. Costs associated with the Denver Uplink Terminal and the Leasehold relate to broadcasting while expenditures for Furnishings and the Studio relate to Programming.

Table 3.A.1

Cost Reallocation FY75[a]

Equipment and Facilities

Expenditure Category	Equipment & Facilities[b] Cost in $	Broadcast & Engineering Cost in $	Programming Cost in $
Personnel Compensation	25,681	25,681	---
Transportation	1,536	1,536	---
Meetings	---	---	---
Rent and Utilities	2,491	2,491	---
Printing and Duplication	---	---	---
Communications	1,955	1,955	---
Sub-contracts	42,000	19,500	22,500
Studio/Access Redundancy Sys	19,500	19,500	---
Studio Equipment Lease	22,500	---	22,500
General and Administrative	3,765	2,572	1,193
Capital Expenditures	109,896	95,266	14,630
Furnishings and Studio	14,630	---	14,630
Denver Uplink Personnel and Leasehold	95,266	95,266	---
Indirect Cost	8,857	---	8,857

[a]Period covers first six months of FY75, July/74-December/74.

[b]Equipment and Facilities = Broadcast and Engineering + Programming.

Table 3.A.2

Cost Reallocation FY74[a]
Equipment and Facilities

Expenditure Category	Equipment & Facilities[b] Cost in $	Broadcast & Engineering Cost in $	Programming Cost in $
Personnel Compensation	13,690	13,690	---
Transportation	860	860	---
Meetings	7	7	---
Rent & Utilities	2,814	2,814	---
Printing and Duplication	---	---	---
Communications	1,021	1,021	---
Sub-contracts	353,071	18,985	334,086
Studio/Access Redundancy Sys	334,086	---	334,086
Studio Equipment Lease	18,985	18,985	---
General and Administrative	9,960	9,389	570
Capital Expenditures	489,480	256,878	232,602
Studio	232,602	---	232,602
Denver Uplink Personnel and Leasehold	256,878	256,878	---
Indirect Cost	7,088	---	7,088

[a]Fiscal Year 1974 covers July 1973-June 1974.

[b]Equipment and Facilities = Broadcast and Engineering + Programming.

Figures are subject to rounding errors.

3.B Allocation of "Rent and Utilities"

The FRMS/STD accounting system charges most Rent and Utility cost to the Management function, a practice which distorts the relative shares of the functional cost areas. Personnel Compensation was selected as the weight in determining expenditure shares for Management, Production, Utilization, and Research and Evaluation (separate Rent and Utilities expenditures were charged against the Technical Department except for FY73). Other possible weights such as floor space by department were either not available or no more justifiable than Personnel Compensation. Let P = total Personnel Compensation for the involved cost categories. Let R = Rent and Utilities, and, for example, let M = Personnel Compensation for the Management function. Then the Rent and Utilities allocated to Management = (M/P) x R.

Fiscal Year 1975*

Cost Center	Personnel Compensation	Percent	Rent and Utilities
Production	300,943	53.84	24,935
Management	95,739	17.12	7,928
Utilization	94,023	16.82	7,790
Research & Evaluation	68,226	12.20	5,650

*For a six month period, July/74-December/74.

Fiscal Year 1974

Cost Center	Personnel Compensation	Percent	Rent & Utilities
Production	482,030	48.12	57,793
Management	181,310	18.10	21,738
Utilization	198,439	19.81	23,792
Research & Evaluation	139,955	13.97	16,778

Fiscal Year 1973

Cost Center	Personnel Compensation	Percent	Rent & Utilities
Production	187,316	20.10	44,118
Management	264,229	28.35	24,895
Utilization	331,958	35.62	35,113
Technical*	149,079	16.00	19,817

*"Rent and Utilities" expenditure had to be imputed for Technical in FY73 because no separate expenditures were recorded. Research and Evaluation was not delineated as a FRMS/STD cost center in FY73.

4. Analysis of the FRMS/STD Cost Data

The basic manner in which the cost analysis will proceed is to compare figures in particular categories over time. These figures are not strictly comparable because total expenditures differ in the three years (FY75 encompasses only six months) which may affect the composition of expenditures, because the accounting structure and the organization itself were dynamic over time, and because assignment of cost to particular expenditure categories and cost centers may be inconsistent between years. However, investigating the cost shares of the different cost centers and expenditure categories will provide insight into the underlying cost function of the ESCD and, then into a more general system of satellite transmitted educational services.

In two of the three years, FY73 and FY74, the largest cost share belonged to Production which also possessed the second largest share in FY75. Technical costs amounted to 35% in FY75, the largest share, and in FY74, Technical had the second largest cost share. The FY73 Technical cost figure was only 15% of total expenditures, coinciding with the relatively small capital expenditures in that year.

The Management function's cost share dropped in relative importance between FY73 and FY74 from 30% to 17% (14% in FY75), though the absolute expenditures for Management between the two years were almost the same. This reflects the new relative importance of expenditures in other categories. The terminated grant for Early Childhood Education was excluded from these figures. Inclusion of this large grant in Management's Sub-contracts expenditure category made the percentage figures for FY73 meaningless in comparisons with other fiscal years.*

*Early Childhood Education expenditures show up in FY74 but will be excluded in future versions of this paper. The size of the expenditure for FY74 is considerably smaller than that of FY73.

However, any costs complementary to the grant but not absorbed directly by the grant would inflate Management costs.

Utilization's percentage of total costs also dropped between FY73 and FY74 while the percentage figures for FY74 and FY75 were close. Part of the drop may reflect the creation of the separate cost center Research and Evaluation--Utilization staff had performed research and evaluative functions. Overall, there was an obvious shift of resources to the Technical function--a fact which explains part of the reductions in the percentage of total expenditures devoted to other functions. (This interdependency among percentage figures suggests caution in interpreting such figures.) Only the Production category retains a consistently large share of the total costs in the face of the increasing share of the Technical cost area.

The increase in the proportion of resources devoted to the Technical cost center is paralleled by an increase in the share of expendiutres for capital. Capital Expenditure was only 7% of the total cost in FY73, was more than triple that in FY74 and more than double that in FY75. However, the single dominant expenditure category was Personnel Compensation, representing, at the least, over one-third of the total of a year's costs. Generally, the shares of the different expenditure categories did not vary much over the three years. Discrepancies between FY73 and FY74 are more marked than those between FY74 and FY75.

The differences in the distribution of costs among the expenditure categories may be the result of the changing needs or demands on the organization as the demonstration progressed. For example, the sharp increase in capital expenditures between FY73 and FY74 and the decrease between FY74 and FY75 reflect heavy investments in preparation for broadcast with a reduction in expenditure after the initial investment. Similarly, transportation costs were high in the formative stage of the ESCD to prepare for operation while heavier meeting costs were incurred at a later date as the Utilization staff required sessions.

The particular functional cost areas can be examined for additional information. For the Technical area, the most striking aspect is the dramatic increase in Capital Expenditure. The increase was so large that Capital Expenditure became the dominant expenditure category, surpassing Personnel Compensation. The Technical function became capital intensive relative to the other cost areas. Combined, Personnel Compensation and Capital Expenditure made-up 60% to 75% of the Technical costs.

Of course, for the Production cost area, Personnel Compensation is the largest category. Production's relative importance to total costs varied significantly over the three fiscal years, and the relative importance of the different expenditure categories to Production costs varied over the years. In both cases, the variation can be explained by the size of the Sub-contract component of Production costs.

The Management cost category is distorted by the presence of the discontinued Early Childhood Education grant in FY73. Still, variation in the distribution of costs among expenditure category is not great over time. The relatively large $170,874 in Sub-contracts in FY74 accounts for some of the variation, but this, part of the Early Childhood Education grant will be removed in future analyses.

Two categories compose most of the Utilization costs, Personnel Compensation and Sub-contracts. Personnel Compensation's percentage share fell through time, but the Sub-contract payments to state coordinators gained in relative importance so the share of labor was maintained relatively high.

Again, inferences based on percentages are tenuous, and since FY75 is only for a six month period, the timing of expenditures in different categories will affect the cost shares of the categories. The descriptions of the data may change greatly as more information is collected and analyzed.

5. Extending the Analysis

The question is, what lessons do the preceding data hold for us with regard to satellite delivered educational services? The immediate answer is, not many. There are a number of difficulties which can be enumerated. First, the FRMS/STD data do not give a complete picture of the ESCD, let alone of a complete educational services system. After data from the Appalachian and Alaskan portions of the experiment are included, something more may be said. However, costs of the non-terrestrial portion of the ESCD must also be incorporated into the analysis to form a total cost account of the existing experimental system. Presently, work is underway to provide estimates of satellite costs. The task of comprehensive cost collection and analysis continues as more data become available.

Second, the operation and organization of a more extensive educational satellite system might differ considerably from the STD. Such a hypothetical system could be large enough to capture economies of scale in the production of capital equipment, and, because it would be a consumer of a considerable amount of technical goods, it might even induce innovation and invention in the production of such goods. Depending upon the nature and size of a hypothesized satellite system, the conditions surrounding its implementation and operation could differ markedly from those surrounding the demonstration. Speculation on the dollar value of the investment to create such a system requires a fairly exact specification of the system itself. Estimates of costs of the system based on the ESCD cost data could be subject to considerable error, but by contrasting the conditions surrounding the ESCD and the assumptions about the hypothetical system, some idea of the magnitude of the errors may be derived.

Third, considering cost figures in isolation is an empty task. They must be compared either with the benefits they yield or with other cost figures.

The ESCD may cost X millions of dollars, and the expenditure might be fully justified for a demonstration, but to say that a proposed satellite system would cost Y millions of dollars, a good question would be: "For What?" This is the key question for any possible investment, and to answer it, it is necessary either to postulate the value of benefits society would accrue from the investment (in this case, perhaps, an intractable problem) or to compare the costs of a particular system which delivers a certain set of educational services with the costs of other means of delivering the same set of services. Another way to approach the same problem might be to estimate the services different educational materials distribution systems can deliver for a given dollar amount. Satellites need to be compared to records, video tapes and other communication media. These are all research prospects which will be further developed and investigated.

Some tentative conclusions can be drawn from the present data set. The Rocky Mountain segment of the STD delivered educational materials and services to fifty-six schools plus twelve public television stations at a cost of over seven and one-half million dollars spread over a thirty month period--this does not include satellite costs or costs incurred before July, 1972 or expenditures for the last half of fiscal year 1975. Not all these costs can be attributed solely to the fact of the delivery of educational services--the ESCD is a demonstration and must be viewed as such. A satellite system has been demonstrated to be a technologically feasible means of distributing educational services. Although it possesses advantages as a delivery system under certain conditions, a satellite system has not been proven to be the single most efficient means of providing those services. Such a judgment would premature at this point.

Since the cost of producing the educational materials which were broadcast--

a significant contributor to overall costs--would be a cost incurred by any comparable distribution system (although the type of delivery system is apt to effect those costs), the other cost functions spell the cost difference among different systems. The major need is to compare different delivery systems under different assumptions regarding desired services. It should be possible to isolate those conditions which favor a satellite system over other systems, and to determine the cases when another system may be more efficient.

APPENDIX TABLES

WORKING TABLE: TECHNICAL

Fiscal Year 1975[a]

Expenditure Category[b]	Broadcast & Engineering Cost in $	Receive Only Terminal Retrofit Cost in $	Equipment & Facilities Cost in $	Total Technical Cost in $	Percent Technical	Percent Total FY75
Personnel Compensation	198,938	---	25,681	224,619	34.81	12.62
Transportation	37,332[c]	2,432	1,536	41,301	6.40	2.32
Meetings	467	---	---	467	0.07	0.03
Rent & Utilities	14,504	---	2,491	16,995	2.63	0.95
Print & Duplication	225	---	---	225	0.03	0.01
Communications	10,136	---	1,955	12,091	1.87	0.01
Sub-contracts	7,875	---	19,500	27,375	4.24	1.54
General & Administrative	14,608	---	2,572	17,180	2.66	0.97
Capital Expenditures	137,867	15	95,266	233,133	36.12	13.10
Indirect Costs	69,053	2,919	---	71,972	11.15	4.04
TOTALS:	491,008	5,367	149,001	645,358	99.98	35.86
Percent Total FY75:	27.59	0.30	8.37	35.86		

[a]Fiscal Year 1975 is for a six month period, July/74-December/74.

[b]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[c]This figure includes $10,844 for terminal installation travel.

WORKING TABLE: PRODUCTION

Fiscal Year 1975[a]

Expenditure Category[b]	Programming Cost in $	Program Talent Cost in $	Equipment & Facilities Cost in $	Total Production Cost in $	Percent Production	Percent Total FY75
Personnel Compensation	252,114	48,828	---	300,943	59.61	16.91
Transportation	4,726	123	---	4,850	0.96	0.27
Meetings	60	---	---	60	0.01	0.00
Rent & Utilities	---	---	---	24,935[c]	4.94	1.40
Print & Duplication	11,620	---	---	11,620	2.30	0.65
Communications	71	---	---	71	0.01	0.00
Sub-contracts	12,995	---	22,500	35,495	7.03	1.99
General & Administrative	9,968	---	1,193	11,162	2.21	0.63
Capital Expenditures	10,380	---	14,630	25,011	4.95	1.41
Indirect Costs	69,640	12,238	8,857	90,736	17.97	5.10
TOTALS:	371,578	61,190	47,181	504,885	99.99	28.36
Percent Total FY75:	20.88	3.44	2.65	28.05		

[a]Fiscal Year 1975 is for a sim month period, July/74-December/74.

[b]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[c]Estimated rental figure imputed only for all production, not for any particular FRMS cost centers.

WORKING TABLE: MANAGEMENT

Fiscal Year 1975[a]

Expenditure Category[b]	Administration Cost in $	Public Information Cost in $	Total $ Management	Percent Management	Percent Total FY75
Personnel Compensation	89,232	6,507	95,739	38.30	5.38
Transportation	8,152	6,139	14,292	5.72	0.80
Meetings	589	1,949	2,539	1.02	0.14
Rent & Utilities	(46,313)[c]	---	7,928[d]	3.17	0.45
Print & Duplication	5,080	10,126	15,207	6.08	0.85
Communications	6,729	155	6,885	2.75	0.39
Sub-contracts	---	---	---	---	---
General & Administrative	30,012	12,921	42,933	17.17	2.41
Capital Expenditures	8,484	---	8,484	3.39	0.48
Indirect Costs	46,527	9,450	55,977	22.39	3.15
TOTALS:	(241,123)[e]	47,250	249,989	100	13.89
Percent Total FY75	(13.55)[e]	2.65	13.89		

[a]Fiscal Year 1975 is for a six month period, July/74-December/74.

[b]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[c]Original rent figure, not included in total management.

[d]Estimated rental figure imputed only for all management, not for any particular FRMS cost centers.

[e]Calculated including the 46,313 for "Rent and Utilities."

WORKING TABLE: UTILIZATION

Fiscal Year 1975[a]

Expenditure Category[b]	Utilization Cost in $	Percent Utilization	Percent Total FY75
Personnel Compensation	94,023	34.37	5.28
Transportation	14,887	5.44	0.84
Meetings	7,362	2.69	0.41
Rent & Utilities	7,790	2.85	0.44
Print & Duplication	---	---	---
Communications	4,273	1.56	0.24
Sub-contracts	112,190	41.01	6.30
General & Administrative	2,332	0.85	0.13
Capital Expenditures	---	---	---
Indirect Costs	30,720	11.23	1.73
TOTALS:	273,580	100	15.20

[a]Fiscal Year 1975 is for a six month period, July/74-December/74.

[b]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

WORKING TABLE: RESEARCH AND EVALUATION

Fiscal Year 1975[a]

Expenditure Category[b]	Research and Evaluation Cost in $	Percent Research and Evaluation	Percent Total FY75
Personnel Compensation	68,266	54.23	3.84
Transportation	6,800	5.40	0.38
Meetings	---	---	---
Rent & Utilities	5,650	4.49	0.32
Print & Duplication	4,620	3.67	0.26
Communications	1,116	0.89	0.06
Sub-contracts	11,274	8.96	0.63
General & Administrative	6,371	5.06	0.36
Capital Expenditures	---	---	---
Indirect Costs	21,794	17.31	1.22
TOTALS:	125,891	100.53	7.00

[a]Fiscal Year 1975 is for a six month period, July/74-December/74.

[b]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

WORKING TABLE: TECHNICAL

Fiscal Year 1974

Expenditure Category[a]	Broadcast & Engineering Cost in $	Receive only Terminal Retrofit Cost in $	Equipment & Facilities Cost in $	Denver Uplink Terminal Personnel Cost in $	Total Technical Cost in $	Percent Technical	Percent Total FY 74
Personnel Compensation	302,134	---	13,690	10,317	326,141	27.79	8.46
Transportation	64,294	1,724	860	1,030	67,910	5.79	1.76
Meetings	410	---	7	37	455	0.04	0.01
Rent & Utilities	32,858	---	2,814	---	35,672	3.04	0.93
Print & Duplication	---	---	---	---	---	---	---
Communications	4,812	---	1,021	8	5,841	0.50	0.15
Sub-contracts	7,500	---	18,985	---	26,485	2.26	0.69
General & Administrative	20,576	---	9,389	7	29,974	2.55	0.78
Capital Expenditure	314,698	---	256,878	12	571,589	48.70	14.84
Indirect Costs	106,271	431	---	2,850	109,552	9.33	2.84
TOTALS:	853,357	2,155	303,647	14,263	1,173,619	100	30.46
Percent Total FY74:	22.15	0.06	7.88	0.37	30.46		

[a]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

WORKING TABLE: PRODUCTION

Fiscal Year 1974

Expenditure Category[a]	Programming Cost in $	Program Talent Cost in $	Equipment & Facilities Cost in $	Total Production Cost in $	Percent Production	Percent Total FY74
Personnel Compensation	463,370	18,659	---	482,030	34.55	12.51
Transportation	15,198	---	---	15,198	1.09	0.39
Meetings	34	---	---	34	0.00	0.00
Rent & Utilities	---	---	---	57,793[b]	4.14	1.50
Print & Duplication	3,762	---	---	3,762	0.27	0.10
Communications	822	---	---	822	0.06	0.02
Sub-contracts	51,402	---	334,086	385,488	27.63	10.01
General & Administrative	46,007	---	570	46,578	3.34	1.21
Capital Expenditures	26,845	---	232,602	259,447	18.60	6.73
Indirect Costs	132,299	4,665	7,088	144,052	10.32	3.74
TOTALS:	739,742	23,324	574,347	1,395,204	100	36.21
Percent Total FY74:	19.20	0.61	14.91	36.21		

[a] Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[b] Estimated rental figure imputed only for all production, not for any particular FIMS cost centers.

WORKING TABLE: MANAGEMENT

Fiscal Year 1974

Expenditure Category[a]	Management (Administration) Cost in $	Percent Management	Percent Total FY74
Personnel Compensation	181,310	28.14	4.71
Transportation	40,468	6.28	1.05
Meetings	1,452	0.23	0.04
Rent & Utilities	21,738[b]	3.37	0.56
Print & Duplication	23,722	3.68	0.62
Communications	7,873	1.22	0.20
Sub-contracts	170,874[c]	26.52	4.43
General & Administrative	71,359	11.08	1.85
Capital Expenditures	21,362	3.32	0.55
Indirect Costs	104,044	16.15	2.70
TOTALS:	644,205	99.99	16.72

[a] Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[b] Estimated rental figure imputed only for all Management, not for any particular FRMS cost centers.

[c] This figure is for the Early Childhood Education grant and will be deleted in future analyses. It strongly distorts the percentage share of total Management costs attributed to expenditure categories. (E.g., Personnel Compensation's Percent Management rises to 38%.)

WORKING TABLE: UTILIZATION

Fiscal Year 1974

Expenditure Category[a]	Utilization Cost in $	Percent Utilization	Percent Total FY74
Personnel Compensation	198,439	46.17	5.15
Transportation	24,874	5.79	0.65
Meetings	393	0.09	0.01
Rent & Utilities	23,792[b]	5.54	0.62
Print & Duplication	100	0.02	0.00
Communications	6,031	1.40	0.16
Sub-contracts	116,035	27.00	3.01
General & Administrative	2,149	0.50	0.06
Capital Expenditures	---	---	---
Indirect Costs	57,997	13.49	1.51
TOTALS:	429,814	100	11.16

[a]Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[b]Estimated rental figure imputed only for all Utilization, not for any particular FRMS cost centers.

WORKING TABLE: RESEARCH AND EVALUATION

Fiscal Year 1974

Expenditure Category[a]	Research Cost in $	Data Processing Cost in $	Total Research and Evaluation Cost in $	Percent Research and Evaluation	Percent Total FY74
Personnel Compensation	99,050	40,904	139,955	66.63	3.63
Transportation	5,324	939	6,264	2.98	0.16
Meetings	352	---	352	0.17	0.01
Rent & Utilities	---	---	16,788[b]	7.99	0.44
Print & Duplication	1,811	50	1,861	0.89	0.05
Communications	423	---	423	0.20	0.01
Sub-contracts	---	---	---	---	---
General & Administrative	234	5,278	5,513	2.62	0.14
Capital Expenditures	66	246	313	0.15	0.01
Indirect Costs	26,799	11,793	38,592	18.37	0.10
TOTALS:	134,063	59,213	210,054	100	5.45
Percent Total FY74	3.48	1.54	5.45		

[a] Expenditure categories are explained in the accompanying text. All figures are subject to rounding errors.

[b] Estimated rental figure imputed only for all Research and Evaluation, not for any particular FRMS cost center.

WORKING TABLE: PRODUCTION AND TECHNICAL

Fiscal Year 1973

Expenditure Category[a]	Production Cost in $	Percent Production	Percent Total FY73	Technical Cost in $	Percent Technical	Percent Total FY73
Personnel Compensation	331,958	51.21	15.59	149,079	46.39	7.00
Transportation	52,962	8.17	2.49	36,992	11.51	1.74
Meetings	3,159	0.49	0.15	386	0.12	0.02
Rent & Utilities	44,118	6.81	2.07	19,817	6.17	0.93
Print & Duplication	159	0.02	0.01	48	0.01	0.00
Communications	187	0.03	0.01	411	0.13	0.02
Sub-contracts	118,667	18.31	5.57	---	---	---
General & Administrative	2,928	0.45	0.14	15,745	4.90	0.74
Capital Expenditures	670	0.10	0.03	48,247	15.01	2.27
Indirect Costs	96,949	14.96	4.55	50,665	15.76	2.38
TOTALS:	651,757	100	30.45	321,390	100	15.10

[a]Expenditure categories and cost centers are explained in the accompanying text.

WORKING TABLE: MANAGEMENT AND UTILIZATION

Fiscal Year 1973

Expenditure Category[a]	Management Cost in $	Percent Management	Percent Total FY73	Utilization Cost in $	Percent Utilization	Percent Total FY73
Personnel Compensation	187,316	29.05	8.80	264,229	51.32	12.41
Transportation	67,350	10.45	3.16	39,967	7.76	1.88
Meetings	1,175	0.18	0.06	---	---	---
Rent & Utilities	24,895	3.86	1.17	35,113	6.82	1.65
Print & Duplication	30,447	4.72	1.43	34	0.01	0.00
Communications	36,279	5.63	1.70	112	0.02	0.01
Sub-contracts	---[b]	---	---	93,932	18.24	4.41
General & Administrative	75,445	11.70	3.54	2,928	0.57	0.14
Capital Expenditures	91,905	14.25	4.32	---	---	---
Indirect Costs	129,968	20.16	6.10	77,160	14.99	3.62
TOTALS:	644,782	100	30.28	514,846	99.73	24.18

[a]Expenditure categories and cost centers are explained in the accompanying text.

[b]A figure of $1,265,746, a grant for Early Childhood Education is excluded because it distorts the remaining figures.

APPENDIX C

WORKING PAPER ON CALCULATING THE ESCD'S TOTAL COST

Introduction

The cost of the Department of Health, Education and Welfare's ESCD program is about $17 million. About three-quarters of this sum was expended on program production and use, not quite 20 percent on equipment and engineering, and the remainder principally for evaluation.

In estimating total costs, a share of the costs of construction and launch of ATS-6 must be added. The purpose of this paper is to describe alternative ways of estimating the latter kind of costs and to discuss the pros and cons of different approaches.

The most important issue is a definitional problem involving the appropriate starting point for the calculation:

> Should the ESCD ATS-6 costs be treated as incremental costs to a fully developed experiment, or should they be treated as some percentage of the total costs of ATS-6--i.e., as one of several equally valid reasons for the experiment?
>
> As a secondary problem, if the percentage approach is adopted, should ESCD ATS-6 costs be assigned only to the operational FY75 period, or should they be assigned to the entire expected life of ATS-6?

Add-on Costs vs. Percentage of Total ATS-6 Costs

The add-on costs of the HET satellite hardware were $2 million, according to DHEW. The share assignable to the ESCD was $1.4 million, which might be taken as the lowest estimate of the incremental costs. On the other hand, if one thinks the more realistic cost is some percentage of total ATS-6 costs, there are several possible ways to compute this percentage. The one used in this

paper is the percentage of the total ATS-6 operating time used by the ESCD. This was about 10 percent which, when applied to total ATS-6 costs of $205 million, yields an ESCD share of $20.5 million. (Additional details are contained in the Appendix.)

Since the two sums differ so greatly, some attention to the pros and cons of each approach seems in order.

There are two arguments for preferring the add-on cost option.

(1) As a matter of historical fact, ATS-6 would have been launched whether HEW had been added or not. So the HET (of which the ESCD is the education component) cannot be realistically considered part of the ATS-6 mission, and hence those other experiments were considered to have justified the total initial design and launch costs.

(2) In the future, it may happen (a) that an educational organization will ask for hardware to be added onto a commercial satellite which is going to be launched anyway and which is not primarily devoted to delivering ETV, and (b) that the commercial organization financing the satellite construction and operation will not charge the educational organization pro rata fees based on total satellite construction and launch costs. Under this assumption, the ATS-6 experience may be a precedent for future educational use of satellites.

There are also two arguments for preferring the percentage of total ATS-6 cost options.

(1) Calculating the ESCD's ATS-6 cost should be guided by the subsequent stress on the HET's importance in ATS-6's mission, not by the order in which experiments happen to be added. The ATS-6 mission (beyond NASA's own mission goals) was to conduct certain technological and scientific experiments. Among the technological goals was the provision of information helpful to making future policy decisions about social service delivery via satellite. HEW

agencies and HET project contractors imply that they believe that the social-service value of ATS-6 is a principal justification for ATS-6's existence. And c rtainly if NASA-HEW-CPB had conceived of the HET in 1964-65 when ATS-F was first being conceived, the HET's potential social-service contribution to the nation would have been included in the original arguments for funding ATS-F.

(2) It is far from certain that educational users of future satellites will not be charged a pro rata share of total satellite costs. To assume that educational users will continue to get especially advantageous treatment may be more optimistic than the facts warrant, especially if educational uses assume more importance.

Costs Based on Experimental Phase Operations vs. Costs Based on Expected Satellite Life

The operational phase of the ESCD is essentially one year, FY75. The expected functional life of ATS-6 is between two and five years. For the sake of illustrating the widest range of costs, the 5-year figure will be used. The reader can easily calculate the effect a shorter functional life estimate would have on ESCD ATS-6 cost estimates.

The arguments for preferring the one year period are that (a) the HET should be considered part of ATS-6's original mission and, (b) that ATS-F funding argument would have justified the funding actually received by NASA even if ATS-6 had been expected to become non-functional at the end of FY75.

There are two arguments for preferring the 5 year time-frame.

First, ATS-6's mission is to conduct technological and scientific experiments generally for as long as the satellite is functional. Therefore, the ESCD should not be weighted any more heavily than will similar projects

which might be run on the satellite over the next four years. Second, projections of costs for a future operational educational satellite project will likely assume a time-frame that coincides with the total expected functional time-frame of the satellite to be used by that educational project. Hence the use of the longer accounting period is more realistic for discussicn of long-range options.

One's preferences for one or the other option in each of these problems is influenced by what one wants to use the ESCD ATS-6 cost data for.

If the ESCD ATS-6 cost estimate is to be used as part of a cost-benefit assessment of the ESCD as a Federal project, then the main question is whether calculating the ESCD ATS-6 cost is guided by the historical add-on sequence or by the HET's overall importance in ATS-6's publicly stated mission, as presently defined. The historical sequence approach may be criticized because that sequence is simply a fact about Federal decision-making, not about the ESCD as a demonstration of satellite technology.

Which time-frame is right for a cost-benefit assessment depends on whether one thinks that ATS-F's original funding rested on (a) only the FY75 experimental mission or (b) a 2-5 year experimental mission.

If the ESCD ATS-6 cost estimate is to be used as a basis for forecasting ways in which costs can or will be apportioned to educational users of future operational satellites, then the 5-year time-frame is clearly more realistic than the one year time-frame. So the main question here is whether future educational organizations will be charged merely an "add-on plus operations" cost or whether they will be charged some percentage of total costs.

The results of mixing these different options for figuring the ESCD ATS-6 cost are as follows:

1. Add-on cost, 1-year time-frame = $1.4 million*
2. Total ATS-6 cost, 5-year time-frame = $3.4 million
3. Total ATS-6 cost, 1-year time-frame = $17.2 million

The difference between the first two results is not very important, but the difference between either of them and the third is very large.

As we noted earlier, there is no single "true" or "best" estimate of the ESCD's share of the ATS-6 vehicle and launch cost. This is because the estimate one might use for calculating the ESCD's share of this particular enterprise would be different from the figure one might use as an estimate of what the costs might be to future educational users renting times on, say, a commercial satellite. However, our major purpose here is to estimate the historical federal cost of this demonstration. And for this purpose the third figure of around $34 million appears to be the most appropriate. However, we also would claim that as the satellite is utilized in future years by additional users, it is only reasonable to impute a share of the vehicle and launch costs to them as well. Thus, we could see the possibility of the ESCD total cost as estimated in this manner, declining through the next several years so long as the satellite continues to function properly and so long as there are groups who are interested in using it.

For the present purposes, then, we see the figure of $34 million as the best estimate of the total cost of the ESCD. This figure could decline with time, but is very unlikely to drop below $20.4 million, the second of our estimates, since this estimate assumes a 5 year pro rata sharing of costs with subsequent users.

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*We assume here that it is inappropriate to combine the incremental approach to the costs of a definite experiment with spreading costs over a longer time period. Each new user may be considered either to get a "free ride," or to pay his share of total costs.

Listing the alternative ways of calculating total ESCD costs is now easy since the HEW terrestrial demonstration cost is a constant figure, about $17 million. Holding to the order of the ESCD ATS-6 cost mix list above, we get:

1. $17 million + $1.4 million = $18.4 million
2. $17 million + $3.4 million = $20.4 million
3. $17 million + $17.2 million = $34.2 million.

AFTERWORD

The assumptions considered in this report have suggested the possibility that somewhere in Brazilia, an obscure, bewildered, but oddly proud meteorologist may be trying to explain to his government how he secured $201.4 million in satellite services from the United States government. The explanation, of course, is that his project, which required ten minutes of atmospheric scanning each day for six weeks, was the first project officially approved by NASA for inclusion on the ATS-6. Since NASA and other governmental agencies adopted the incremental approach to costing out non-terrestrial satellite services, the Brazilian meteorologist was assigned all the initial costs of the experiment, and everything else was treated as an add-on. No one objected to this, and the State Department was pleased by the increase in non-military aid to a Latin American ally. The meteorologist's superiors are subjecting him to close questioning about how he came to control that much money and why they saw none of it. He will either become a great man or be ruined for life.

CALCULATION DETAILS

ESCD and HET Terrestrial Costs

The total U.S. Office of Education and National Institute of Education costs for the ESCD FY72 through FY75 are:

Program Development and Use:	$12,556,902	(75%)
Site Hardware and Engineering:	2,987,228	(18%)
Evaluation:	1,178,251*	(7%)
TOTAL	$16,722,381	

*Includes $215,538 from The Office of the Secretary, HEW.

This figure does not include funds to project contractors from HEW offices other than USOE and NIE. Funds from other offices by and larger were allocated early in the project or will be allocated after its operational termination. They were and will be devoted primarily to planning and evaluation. Not all of these monies have been identified, but it is fairly certain that they will bring the total HEW contribution to the ESCD up to somewhat over $17 million.

It is estimated that the total cost of the health component of the HET is approximately $3 million. Therefore, the total cost of the terrestrial HET experiment is slightly over $20 million.

The ESCD's share of total broadcast time devoted to the HET as a whole during a normal week is about 70 percent of the total time devoted to HET's 30-plus hours. So, ESCD's share of HET broadcast time equals 70 percent.

Appropriate Time-Frame

The operational phase of the terrestrial HET experiment is approximately

one year. The expected lifespan of ATS-6 is 2 to 5 years. Taking the limiting case of 5 years is best suited to the purposes of this paper.

Total ATS-6 and Total HET Spacecraft Modification Costs

There are two sources of this data:

1. The HET Office of Telecommunications Policy

   a. Satellite/Vehicle Costs

      Construction: $180 million
      Launch: 25 million

      TOTAL $205 million

   b. Cost of Modifying Spacecraft for HET Experiment: $2 million

2. Fairchild's ATS-F Cost Study (20 September 1974).

   a. Satellite Construction Cost: $121 million

   This includes: Communications Subsystem

      (1) Design and Development, TSM, and ATS-F only $16 million

      (2) Total including ATS-F, Flight Spares and AGE $19 million

   b. The "HET" line-items in the Cost Study give us a spacecraft modification figure of approximately: $1.2 million

It is felt that some costs in the total NASA outlay for the HET component add-on are "hidden" expenses which are not easily estimated. For this reason, OPT's figures ($2 million) will be considered to be the more authoritative.

For any chosen time-frame, there are several alternative assumptions or criteria to choose from in determining the HET's share of the total cost of the satellite. Three of many possible candidate estimating parameters will now be discussed. However, only the first of these three will actually be used in

the preliminary calculations of ESCD costs.

(A) The "Operating Time" Parameter.

Time unites offer the simplest measures of relative magnitudes of use by the many experiments being conducted on ATS-6 for FY75. Goddard Space Flight Center tabulates this operating time data regularly and has made it publicly available.

The HET shares of total use of ATS-6 by all experiments for each month during the period 6/74 through 1/75 are as follows:

TABLE I.

MONTH	HET (hrs)	ALL EXPERIMENTS (hrs)	PERCENTAGE
June 1974	37	336	11%
July	69	541	13
August	66	652	11
September	129	780	17
October	126	899	14
November	110	789	14
December	104	790	14
January 1975	115	1024	12
TOTAL	756	5811	13%

If we assume that HET Experiment use will decline drastically after May 1975, then a rough estimate of HET's overall operating time share of the use of ATS-6 would be about 10 percent.

This is treated here as only an "assumption" because a strong case can be

made for not ignoring non-temporal technically substantive differences among the various experiments. For example, some of the experiments are scientific in nature and not subsumable under the "communications" rubric. Many of the other strictly communications experiments involve only audio or data transmission. This consideration is especially appropriate to cost estimates of future educational uses of this technology. One video channel uses spectrum space equivalent to a large number of audio channels. It can thus be argued that calculation of HET's share of ATS-6 use ought to take into account these and other differences among the experiments. Two possibilities come to mind which might better take these differences into account than does the "operating time" parameter.

(B) Bandwidth: Multiply the operation duration quantities in Table I by the bandwidth needed by the signals used in the particular experiment. This alternative may be sensitive, for instance, to regulatory constraints on the amount of spectrum space that will be made available for educational satellite communications.

(C) Power Consumption: Multiply the operation duration quantities in Table I by the power consumption (in watts) for the experiment in question yielding the total power demand on the satellite for the month. This alternative is sensitive, for instance, to hardware limitations and costs as a function of the broadcast frequencies used (broadcasting a signal of a certain bandwidth at a low frequency requires less power than broadcasting it at a higher frequency).

Preferring either of these last two measurement parameters to the operating time parameter would make a considerable difference to the calculation of the HET's share of the total use of ATS-6. Generally, using these parameters would

yield a higher estimate of the HET's share than 10 percent, the amount derived from using the "operating time" parameter. However, since this paper is preliminary and intended for purely illustrative purposes and because computing bandwidth and power consumption magnitudes for every FY75 experiment is difficult, the following array of alternative calculations of the ESCD's total cost will not include calculations using these parameters.

The Calculation Alternatives

1. Calculation Invariants

   a. HEW's cost of the ESCD = $17 million

   b. The ESCD's proportion of total HET broadcast time on ATS-6 = 70%

2. Alternative Calculation Variables and Assumptions

   a. The proper time-frame for this calculation is one year.

   b. The proper time-frame for this calculation is five years.

   c. The proper HET ATS-6 cost for this calculation is $2 million.

   d. The proper HET ATS-6 cost for this calculation is some fraction of $205 million.

   e. The HET's share of total experimental use of ATS-6 during FY75 is 10% = .1.

3. Alternative Calculations

			ASSUMPTIONS
1.	$17 mil. + $\frac{\$2 \text{ mil.} \times .7}{5}$ =	$18.4 mil.	(b, c)
2.	$17 mil. + $\frac{\$205 \text{ mil.} \times .1 \times .7}{5}$ =	$20.4 mil.	(b, d, e)
3.	$17 mil. + $\frac{\$205 \text{ mil.} \times .1 \times .7}{1}$ =	$34.2 mil.	(a, d, e)

It may later become useful to have a break-out of the relative weights of the elements of the spacecraft.

TABLE II.

SUBSYSTEM	
Structure	815.36 lbs.
Thermal Control	126.49 "
Telemetry and Command	104.80 "
Electrical Power	619.63 "
Stabilization and Control	408.16 "
Communications	316.58 "
Parabolic Reflector	191.23 "
GFE Experiments	502.30 "
TOTAL	3084.55 lbs.

TABLE III.

COMMUNICATION SYBSYSTEM

Item			
Prime Focus Feed	58.95 lbs.	C-Band Transmitter	28.26 lbs.
C-Band Receiver	6.34 "	L-Band Transmitter	11.18 "
L-Band Receiver	1.26 "	S-Band Transmitter	8.89 "
S-Band Receiver	11.53 "	UHF Transmitter	22.62 "
VHF Receiver	7.50 "	HET Experiment	17.50 "
IF Components	42.61 "	Transponder Power Supply	7.99 "
Synthesizer	30.50 "	RFI Experiment	7.13 "
Monopulse Unit	3.40 "	Transponder Command Decoder	26.97 "
Wide Band Data Unit	3.48 "	R.F. Cables	9.09 "
		Miscellaneous	11.38 "
		TOTAL	316.58 lbs.

APPENDIX D

WORKING PAPER ON UTILIZATION OF TELEVISED INSTRUCTION

A Review of the Literature

A review of the literature on instructional television (ITV) demonstrates that the important question to be asked is no longer whether or not people can learn from ITV, for it is clear that they can. In summarizing the "state of ITV research efforts" DuMolin (1971) writes:

> The decade of educational television began about 1955 and was supported by such organizations as the Ford Foundation and the Carnegie Commission. Again a series of "evaluative" studies were done, much in the same style of the pre-1950 research on film. The most authoritative of these studies were: Kanner (1958) on the use of ITV by the Army; Carpenter and Greenhill (1958) on ITV in the university; Gropper and Lumsdaine (1961) on the relationship of student response in programmed instructional modes to televised instruction; and Chu and Schramm (1967) a review of the literature. In general, the findings from hundreds of studies show that ITV is of over-all equal effectiveness when compared with face-to-face instruction.

With the question of the comparative learning effectiveness of ITV in abeyance, two important questions remain for current consideration: (1) What are the criteria for deciding when the use of ITV is preferable to non-ITV? Are the considerations, for example, the subjects to be taught, student characteristics, comparative costs, characteristics of the system, etc.? and (2) What affects the use of ITV when it is available? This paper will be concerned with the second of these questions.

Findings such as those cited above about the effectiveness of ITV no doubt inspired some of the spending of educational funds for television equipment which has taken place in the United States in recent years. Statistics collected by the National Center for Educational Statistics (NCES) in the spring of 1970

indicate that as of that date 75% of all schools had TV, 26% had videotape recorders (VTR), 9% had closed circuit Instructional Television Fixed Service (ITFS) systems, and 55% had radios. Only 13% of the public schools had none of the above forms of instructional technology. This was the first time these statistics had been gathered; the NCES projected no trends from them. In the fall of 1972 a comparative study of the in-school utilization of the 'Electric Company' between Fall 1971 and Fall 1972 was undertaken. Surveys showed that the number of "blacked out" schools (schools without the appropriate equipment for reception or with broken equipment or with equipment which could not receive the channel on which the 'Electric Company' was being shown in that area) declined from 49% to 40% with large gains in technical capability being made in the Southeast and substantial gains in the North Atlantic and in small cities and rural areas and among higher socioeconomic status communities.

The experience of Hagerstown, Maryland a decade ago may have led some to expect that television would assume a substantial share of the instructional burden nationally. According to Ide (1970), ITV in Hagerstown accounted for 10-14% of classroom time in elementary schools, 35% in grades 7 and 8, and 17% in grades 9 through 12. Each student in the system had at least one period of ITV every day. These figures might appear to justify one in having high hopes for the future of ITV, but as Sussman (1973) reminds us:

> It must be remebered that Hagerstown had the most intensively developed in-school television system in the United States, with grants totaling $1,173,910, and contributions of more than $300,000 worth of equipment. The [high] utilization rates... were at least in part the product of an extensive, systematic installation and utilization program, based on a "searching analysis of the system's goals" (Wagner, 1969). The medium was directed at achieving defined, targeted instructional objectives, and once instituted the internal school allocation of resources yielded priority to the utilization of the new medium.

But whatever past expectations may have been, recent research suggests that classroom utilization of television is quite low nationally. In a survey of 16 urban centers, Benton (1970) (as cited in Sussman, 1973), reported that ITV accounts for less than 3% of classroom time. In January, 1970 the Commission on Instructional Technology stated that television, films, and programmed texts taken together affected less than 5% of classroom time.

These percentages do seem "low." But the problem of "How low is low?" has not really been resolved. The literature surveyed for this preliminary report contains suggestions for the amount of classroom time which could be profitably spent using ITV which range from one-tenth to one-third of the student's time (DuMolin, 1971; Wagner, 1969; Sussman, 1973). And, of course, the problem of determining an optimum utilization rate is complicated by the problem of determining a standard index of utilization. For example, should researchers compare the use of television with the use of other forms of instructional technology such as tape recorders, overhead projectors, films, or even books? Or should they record the number of times the television set is used, or the number of live broadcasts viewed, or the number of students watching the program, or the number of teachers using television programs?

Leaving aside these problems, what does appear to have a significant effect on the rate of utilization of existing ITV capability, however utilization is defined? Sussman (1973), in a study of the utilization of educational television in the Borough of York, Ontario, used the number of teachers using broadcast ETV and/or ETV videotapes as the criterion of utilization. She found that the amount of utilization is significantly affected by the ratio of teachers to pieces of equipment. When schools with a higher than average (for York)

teacher/set ratio were compared with schools with lower than average (for York) teacher/set ratio, Sussman found that twice as many teachers used the equipment in the better equipped schools. (A correlation coefficient [r] of .49 resulted from a linear regression analysis.) Also, among using teachers, the number of viewings per teacher tended to be higher in the better equipped schools. Similar results had been found by Dirr (1970) in his study of teachers using the WNDT broadcasts and services in New York, and by Jaffe (1965) in his re-analysis of the data collected in an earlier study of the use of programs broadcast by the New York State Regents Educational Television Project. Not surprisingly, when equipment is readily available, teachers are more likely to use it.

Sussman and Dirr also found that utilization rates tend to be highest in elementary school and to decline in secondary school. This finding is consistent with the conclusion of Chu and Schramm (1967) who in their review of the literature concluded that "teachers and pupils are more favorable toward the use of instructional television in elementary school than in secondary school and college." Chu and Schramm also found that teacher attitudes are more likely to be favorable when television is used to do something significantly new and obviously needed. Logically, greater frequency of use might well follow more favorable teacher attitudes.

A surprising finding of both Sussman's study and Dirr's study was that the quality of reception does not significantly affect the frequency of use of the equipment. Sussman sought to explain this finding by suggesting that teachers are well accustomed to faulty equipment and that, if they believe in the educational value of the material, they will put up with poor reception in order to receive the program.

Another surprising finding was reported by Henshaw in his re-analysis of the data collected in 1962 concerning the use of the programs broadcast by the New York State Regents Educational Television Project. He found that the presence or absence of an in-school television coordinator made no consistent difference in the utilization of classroom television.

Because of the increasing in-school utilization of the "Electric Company" between Fall 1971 and Fall 1972 and because the generally high rate of utilization of that program runs counter to the usual trend of low utilization, the findings of the study of this project reported in 1973 (Liebert) have particular interest. An earlier study done in the Fall of 1971 showed that 23% of all schools and 45% of the schools having the technical capability to receive the program had adopted the series within the first two months of broadcast. By the second year, 35% of all schools and 58% of the technically capable schools were viewing the program. The teachers' opinions tended to be increasingly favorable with greater experience with the series. There was a trend toward increasing representativeness of the nation's schools among the adopters.

In response to a multiple choice question, teachers indicated as reasons for their favorable opinion of the series (in addition to help in teaching reading) such features as the following: the series increased the students' enthusiasm about the school's instructional program; viewing the series breaks up the pace of the day; the series exposes pupils to minority groups; the series enhances the teaching of art and music; and the series provides topics around which lessons can be organized.

The categories most frequently indicated by school principals as reasons for non-use of the "Electric Company" were technical, i.e., lack of the appropriate

equipment in functioning order. The chief non-technical reason indicated was scheduling conflicts (mentioned by 35% of fully-capable non-users). The other reasons indicated included programmatic features such as inappropriate content or manner of instruction, inability of students to identify with the character, or a belief that the program would not be as effective as the regular reading program and inexperienced teachers. (These reasons were given respectively, by 6%, 1%, 3%, 15%, and 12% of fully-capable non-users.) Sussman cites similar reasons for non-use. Inconvenient and rigid scheduling was again the primary reason for low utilization. Other reasons included unsuitable material, problems concerned with difficulties in arranging to secure the equipment, poor reception, and faulty equipment. Many of the researchers cited in this paper have sought to interpret their findings in terms of recommendations about how to increase the percentages of the school day devoted to ITV and/or how to increase the use of present ITV capacity, whenever a particular school thinks that such increased utilization is desirable. The following list is a summary of those suggestions found in the literature surveyed for this preliminary report:

(1) Many suggestions in the literature concern the need for careful planning and for recognition of the radical "otherness" of television.

(a) The lesson of Hagerstown is incorporated in Wagner's (1969) recommendation. He holds that the programming and planning phases should be fully complete before the introduction of ITV into a school system. Television <u>should</u> be "regarded as a complete sub-system within the school system... necessitating an examination in terms of its 'fit', structurally and functionally,

with other sub-systems as they all pursue and contribute to the system's educational goals."

(b) Patron (1964) suggests that to secure any substantial level of utilization, television must be regarded as something other than another audio-visual aid. "To use it fully would require a redefining of roles in the world of education, and a redefinition of the teaching function; it would demand a rethinking of educational goals, curriculum, classroom organization and management, and evaluation procedures."

(2) Schramm et. al. (1967) emphasize the importance of using television to do something new and obviously needed and of large scale. Thus educators would do well to concentrate "the potential of [the] new media on the most urgent 'change point' in the system--that is, the places where educators argree that change and improvement are strongly needed but most difficult to achieve by ordinary means. Herein lies the basic difference between an 'enrichment' approach and more strategic and advantageous uses of the new educational media." (Schramm, Coombs, Kahnert, and Lyle, 1967 as cited in Chu and Schramm, 1967.)

(3) Since teachers are often the ones who ultimately decide whether or not television will be used (76% of teachers surveyed in the "Electric Company" utilization study stated that they had made the decision for their class to view the program), many suggestions in the literature concern ways to encourage teachers to have favorable attitudes toward the medium.

(a) In a school in which not every class is equipped with television (and few are--according to the National Center for Educational Statistics' survey cited earlier, in 1970 the median number of television sets per school was 2), reinforce those teachers who have shown a tendency to use television by making the equipment the most readily accessible to them. Perhaps their positive experiences will encourage other teachers to try using the medium.

(b) Equip every teaching station with a receiver so that the equipment will be readily available. (Dirr, 1970 and Wagner, 1969.)

(c) Make sure that the teachers who are using the medium are encouraged to communicate their experiences to non-users.

(d) Courses in ITV should be included within teaching training programs in colleges and universities. Teachers already working in the schools should be trained in the medium through in-service training courses.

(e) Teachers who wish to specialize in various aspects of ITV should be given released time and otherwise rewarded for their efforts.

(f) Off-the-air video taping should be used to avoid scheduling problems.

No one who has thought about the problem for any time at all would be surprised to learn that utilization rates could be increased by proper planning, by using the medium to address areas of great need, and by taking steps to

insure that teachers have positive attitudes toward the medium. These suggestions are as true, probably, as they are obvious. But the difficulties of complying with them remain.

> Presently...those concerned with the utilization of television facilities in the schools are bound to deal with the issues within the limitations placed upon them by the existing school systems. That is, they must work within the restrictions of schools equipped before primed for being equipped, filled with people whose understanding of television is new and often limited to seeing it either as an entertainment medium, or as a cumbersome audio-visual aid." (Sussman, 1973)

When examined in detail, the studies surveyed in this report are frequently inconclusive like many studies of dissemination of innovation in education. In commenting on the utilization study of the New York State Regents Educational Television Project cited earlier, Allen H. Barton, then director of the Bureau of Applied Social Research, Columbia University, commented:

> New techniques appear and spread; they become a small part of the process of education at many (but not all) schools; and it is not easy to find what determines the adoption and extent of use of innovations which form one more element in the battery of methods used by the schools... Perhaps what is needed is a much better basic understanding of the social processes of education, both those which go on in the schools and those which go on in the family and community. When basic research has revealed these social processes, we will then be able to see how particular devices or forms of organization fit into them, and why so many changes are initiated only to produce marginal results, or to attain partial utilization.

Notes for Future Research and Analysis

(1) The conceptual problems raised earlier in this paper concerning different ways of measuring utilization and different notions of what would count as optimum utilization may prove unanswerable in any general way. It may be that such questions can be given sense only within the context of a particular school or school

district where the educational objectives can be specified in a detailed enough way to permit serious consideration of which parts of the curriculum, if any at all, can be effectively transmitted by ITV. Nevertheless, it may be possible to formulate a series of questions which an educator can ask in an effort to determine whether his school's present investment in ITV is worth it and whether or not further investment is warranted. In such a decision-making context multiple indicators of utilization could be used.

If this hypothesis is correct, then an analysis needs to be made of: (1) decision-making criteria which are helpful in setting utilization goals at the local level; (2) decision-making criteria which federal agencies could use in determining how to make grants to local communities to assist them in developing ITV programs. It would be important to determine, for example, which kinds of local groups are most experienced in addressing goal-setting.

(2) Since utilization tends to be highly correlated with the quantity of equipment available, consideration needs to be given to determining what the optimum amount of equipment for a particular school's needs would be--too little might result in infrequent use because the equipment could not be readily available, while having too much (i.e., many more sets, for example, than are ever needed at any one time) would be an obvious waste of money. Duane (1973) has argued that, with the use of Piggyback Units (TV plus video tape playback machine on an easily movable cart), only two or three

such units plus a full-time technician with student help would be required per school. Clearly this question cannot be settled in isolation from the first one.

(3) It has been argued elsewhere in this report that the most promising mode of satellite usage would be some kind of materials distribution service. A review of the literature on ITV utilization tends to support that conclusion. Rigid scheduling such as would be required for real-time reception tends to be the most frequently cited reason for non-use among technically capable users. In 1970 the median number of television sets per school was two. This fact obviously limits the number of students in a school who can be watching the same broadcast at the same time. The satellite could, however, transmit materials to be recorded and replayed at the teacher's convenience. This would require further investment by the schools in VTR's. (Only 26% had VTR's in 1970.) Whether or not a satellite system would be the most cost-effective distribution system and whether or not copyright problems raised can be overcome are items for further analysis.

(4) Henshaw's finding, cited earlier, that the presence or absence of a television coordinator in the school made no consistent difference in utilization of classroom television is so surprising that further study needs to be made of the significance of and roles of utilization staffs both within and outside of the schools. Was Henshaw's report due to peculiar conditions within that experiment? The need for such persons could be a factor in comparative economic analyses of

alternative delivery systems or simply in assessing the cost of a satellite-based system.

(5) The statistics suggest that a substantial commulative investment has already been made by the schools in ITV equipment. If a satellite system can be used cost-effectively to distribute quality materials to the schools, perhaps greater benefit can be had from the present investment. But would the benefit gained be worth the additional investment?

(6) The utilization study of the "Electric Company" reported that, when reasons were given for non-use by fully capable schools, programmatic features were infrequently mentioned (such features were checked by only 15% of capable but non-using schools). The researchers commented that local program needs may not be as diverse as has been sometimes assumed. Further study should be given to the conditions under which it is reasonable to undertake local program development and to ways of using more fully already existing programs. As an example of the latter sort of enterprise, Borton et. al. (1973) studied the use of dual audio TV instruction as an attempt to increase learning from commercial TV by providing supplementary educational commentary on a simultaneous radio broadcast. In this experiment, public school teachers wrote the radio scripts. But, since the experiment resulted in an increase in the number of children watching the television programs (the viewing was done voluntarily at home rather than in school), perhaps the commercial networks might be persuaded to produce such scripts.

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